EXHIBIT 7

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re *Ex Parte* Reexamination of:	)	
	)	
U. S. Patent No. 7,933,431	)	Control No.: *To be assigned*
	)	
Issue Date: April 26, 2011	)	Group Art Unit: *To be assigned*
	)	
Inventor: Timothy R. Pryor	)	Examiner: *To be assigned*
	)	
Appl. No. 12/834,281	)	Confirmation No.: *To be assigned*
	)	
Filing Date: July 12, 2010	)	
	)	
For: CAMERA BASED SENSING IN HANDHELD, MOBILE, GAMING, OR OTHER DEVICES	)	

Mail Stop *Ex Parte* Reexam
Attn: Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

REQUEST FOR *EX PARTE* REEXAMINATION OF U.S. PATENT NO. 7,933,431

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I. Introduction

An *ex parte* reexamination is requested on claims 1-31 ("the challenged claims") of U.S. Patent No. 7,933,431 that issued on April 26, 2011 to Pryor ("the '431 patent," Ex. PAT-A), for which the U.S. Patent and Trademark Office ("Office") files identify Gesture Technology Partners, LLC ("GTP") as the assignee. In accordance with 37 C.F.R. § 1.510(b)(6), Requester Samsung Electronics Co., Ltd. ("Requester") hereby certifies that the statutory estoppel provisions of 35 U.S.C. § 315(e)(1) and 35 U.S.C. § 325(e)(1) do not prohibit it from filing this *ex parte* reexamination request.

This request raises substantial new questions of patentability based on prior art that the Office did not have before it or did not fully consider during the prosecution of the '431 patent, and which discloses the features recited in the challenged claims.[1] The Office should find the claims unpatentable over this art.

On February 4, 2021, Patent Owner ("PO") initiated a litigation campaign asserting, *inter alia*, infringement of the '431 patent against five defendants across two different venues in *Gesture Technology Partners, LLC v. Huawei Device Co., Ltd.*, Case No. 2:21-cv-00040 (EDTX), *Gesture Technology Partners, LLC* v. Samsung Electronics Co., Ltd., Case No. 2:21-cv-00041 (EDTX) (consolidated with Case No. 2:21-cv-0040 for all pretrial issues), *Gesture Technology Partners, LLC v. Apple Inc.*, Case No. 6:21-cv-00121 (WDTX), *Gesture Technology Partners, LLC v. Lenovo Group Ltd.*, Case No. 6:21-cv-00122 (WDTX), and *Gesture Technology Partners, LLC v. LG Electronics, Inc.*, Case No. 6:21-cv-00123 (WDTX). The *LG* case was transferred to *Gesture Technology Partners, LLC v. LG Electronics Inc.*, Case No. 2-21-cv-19234 (DNJ). Requester respectfully urges that this Request be granted and that reexamination be conducted with "special dispatch" pursuant to 35 U.S.C. § 305.

[1] At the time of filing of this Request, there are three pending *inter partes* reviews (IPR2021-00917, IPR2021-00920, and IPR2022-00091) challenging the claims of the '431 patent based on prior art not asserted in this Request. Further, as explained in Section V.F.1, while *Pinkney* (Ex. PA-6, which is used as a secondary reference in SNQ6) was identified in the '431 patent (Ex., PAT-A, 2:35, 3:63-4:28, 4:59-62, 24:31-34,), that reference is not identified as a "Reference[] Cited" by the Patent Office during examination of the '431 patent (*id.*, Cover (References Cited)), and the file history shows no evidence that the reference was considered as prior art during examination of the '431 patent (*generally* Ex., PAT-B (file history of the '431 patent)).

In accordance with 37 C.F.R. § 1.20(c)(1), the fee for *ex parte* reexamination (non-streamlined) is submitted herewith. If this fee is missing or defective, please charge the fee as well as any additional fees that may be required to Deposit Account No. 50-2613.

II. Identification of Claims and Citation of Prior Art Presented

Requester respectfully requests reexamination of claims 1-31 of the '431 patent in view of the following prior art references, which are also listed on the attached PTO Form SB/08 (Ex. PA-SB08).

Exhibit PA-1	U.S. Patent No. 5,982,853 to Liebermann ("*Liebermann*")
Exhibit PA-2	U.S. Patent No. 6,385,331 to Harakawa *et al.* ("*Harakawa*")
Exhibit PA-3	U.S. Patent No. 6,191,773 to Maruno *et al.* ("*Maruno*")
Exhibit PA-4	U.S. Patent No. 5,644,324 to Maguire ("*Maguire*")
Exhibit PA-5	U.S. Patent No. 6,198,845 to Mack *et al.* ("*Mack*")
Exhibit PA-6	U.S. Patent No. 4,219,847 to Pinkney *et al.* ("*Pinkney*")

A copy of each of the above-listed references is attached to this request pursuant to 37 C.F.R. § 1.510(b)(3). A copy of the '431 patent is also attached to this request as Exhibit PAT-A pursuant to 37 C.F.R. § 1.510(b)(4).

III. Overview of the '431 Patent

A. Overview of the Specification and Drawings of the '431 Patent

The '431 patent generally relates to "simple input devices" for "optical[] sensing." (Ex. PAT-A, 2:7-11.) The devices are particularly "intended for use with 3-D graphically intensive activities," and operate by "optically sensing a human input to a display screen or other object

and/or the sensing of human positions or orientations." (*Id.*, 2:8-11.) The optical sensing devices may use "single or multiple TV cameras whose output is analyzed and used as input to a computer, such as a home PC, to typically provide data concerning the location of parts of, or objects held by, a person or persons." (*Id.*, 2:20-23.) Alternatively, "suitable electro-optical sensors" may be used in place of the TV cameras. (*Id.*, 3:21-22.) Furthermore, the devices may involve "the combination" of the aforementioned functions "with the basic task of generating, storing and/or transmitting a TV image of the scene acquired—either in two or three dimensions." (*Id.*, 3:23-26.)

The '431 patent alleges that such sensing devices are applicable "in a variety of fields such as computing, gaming, medicine, and education. (*Id.*, 2:15-17.) Thus, the '431 patent purports to disclose "new applications" in these fields and "seeks to provide further useful embodiments for improving the sensing of objects" as well as "improved systems for display and control purposes." (*Id.*, 2:14-19.) Figure 2, for example, "illustrates object tracking embodiments of the invention employing a pixel addressable camera" and "discloses special types of cameras useful with the invention." (*Id.*, 2:42-43, 4:42-43.) One of these camera embodiments is FIG. 2A (reproduced below). (*Id.*, FIG. 2A.)

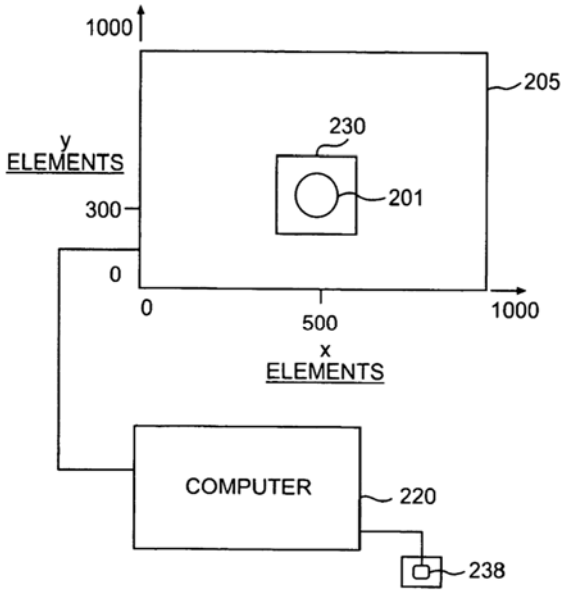


FIG. 2A

(*Id.*, FIG. 2A.)

In FIG. 2A, "a pixel addressable camera such as the MAPP2200 made by IVP corporation of Sweden is used, which allows one to do many things useful for rapidly determining location of

objects, their orientation and their motion." (*Id.*, 4:43-47.) "[A]n approximately circular image 201 of a target datum . . . may be acquired by scanning the pixel elements on a matrix array 205 on which the image is formed." (*Id.*, 4:48-51.) "[C]omputer 220" can then determine, "after the array 205 has been interrogated," where "the centroid 'x,y' of the pixel elements on which the target image lies"—for example, at "pixel x=500, y=300 (including a sub-fraction thereof in many cases)." (*Id.*, 4:56-59.) The target image, which the camera can subsequently track, "is defined as a contrasting point on the object, and such contrast can be in color as well as, or instead of, intensity." (*Id.*, 4:63-65.) Alternatively, with additional preprocessing the target can be "a distinctive pattern on the object, such as a checkerboard or herringbone." (*Id.*, 4:65-5:2.)

Using a camera embodiment as in FIG. 2A "avoids the necessity to scan the whole field" for a target image's subsequent movements. (*Id.*, 5:16.) Instead, when "subsequently track[ing] the movement of this target image, it is now only necessary to look in a small pixel window composed of a small number of pixels around the target." (*Id.*, 5:2-4.) For example, it would now only be necessary to look in "the square 230 shown, as the new position x'y' of the target image cannot be further distant within a short period of time elapsed from the first scan, and in consideration of the small required time to scan the window." (*Id.*, 5:4-8.) Thus, "once the starting target image position is identified," which "can be known by an initial scan as mentioned," then subsequent tracking of the target image does not involve scanning the whole field. (*Id.*, 5:15-17.)

While the challenged claims broadly recite limitations relating to some of these high-level features, as demonstrated below, such features were already known and disclosed in the prior art before the alleged invention.

B. Claims of the '431 Patent

The '431 patent includes 31 claims, with claims 1, 7, and 14 as the independent claims. (Ex. PAT-A, claims 1-31.) The three independent claims have significant overlap, as all three relate to controlling a handheld device using information relating to a portion of a user's body or an object held by the user, but there are distinct differences in claim language between the three claims. (*Id.*, claims 1, 7, 14.) Among other limitations, claims and 14 recite "[a] method for controlling a handheld computing device," while claim 7 recites a "[h]andheld computer apparatus." (*Id.*) Claim 1 comprises "holding said device in one hand," while claims 7 and 14 have no such requirement. (*Id.*) Claim 7 requires "a housing" with a "computer means within said

housing," and claim 14 "provid[es] a computer within said device," but claim 1 does not have a computer or housing limitation. (*Id.*) Claim 1 recites controlling the device using "sensed finger movement information," claim 7 recites controlling an apparatus function using "information concerning a position or movement" of "at least one object positioned by a user operating said object," and claim 14 recites controlling a device function using "information concerning a user input command" determined from "image data" of "at least a portion of the body of a user . . . or an object held by said user." (*Id.*) Claim 1 also involves "electro-optically sensing [reflected] light," while claims 7 and 14 involve a camera to capture the above-described information. (*Id.*)

The dependent claims further specify, among other limitations, a camera to effect electro-optical sensing; acquiring an image of a portion of the user; sensing movement in three dimensions; sensing a variety of finger and body movements; controlling a display function; using a 3D display; using a stereoscopic display; transmitting information and transmitting data to a further device; providing a light source; providing a cellular phone; determining position, changes in position, velocity, and path of a portion of a user's body; moving a virtual display image; operating a camera at certain frames per second; providing a game-related controlled function; and aiding speech recognition. (*Id.*, claims 2-6, 8-13, 15-31.)

C. The '431 Patent Prosecution History

The application leading to the '431 patent—U.S. Patent Application No. 12/834,281—was filed on July 12, 2010, as a continuation of application No. 11/980,710, filed on October 31, 2007 (now U.S. Patent No. 7,756,297), which is a continuation of application No. 10/893,534, filed on July 19, 2004 (now U.S. Patent No. 7,401,783), which is a continuation of application No. 09/612,225, filed on July 7, 2000 (now U.S. Patent No. 6,766,036), which claims benefit of U.S. Provisional Application No. 60/142,777, filed July 8, 1999. (Ex. PAT-A, Cover.)

During examination, the Examiner allowed original claims 1-6 and 14-31, but also objected to claim 14 because of a typographical error. (Ex. PAT-B, 82.) The Examiner rejected claims 7-13 because the claim recited the limitation "a camera means associated with said housing for obtaining an image using reflected light of at least one object positioned by a user operating *said device*" and there was a lack of antecedent basis for "said device." (*Id.*) Claims 8-13 were rejected as being dependent upon claim 7. (*Id.*) Following amendment of these claims, the Examiner allowed all of claims 1-31 because the rejections and objections had been resolved and because

"[p]rior art of record, taken alone or in combination, fails to teach all the features in independent claims 1, 7 and 14." (*Id.*, 104.)

The references forming the substantial new questions of patentability—*Liebermann*, *Harakawa*, *Maruno*, *Maguire*, *Mack*, and *Pinkney*—were not considered during prosecution of the '281 application.[2] (Ex. PAT-A, Cover (References Cited); Ex. PAT-B.) Likewise, these references are not cited and will not be considered as asserted prior art in the pending IPRs. *Unified Patents, LLC v. Gesture Technology Partners, LLC*, IPR2021-00917 (filed May 14, 2021); *Apple Inc. v. Gesture Technology Partners, LLC*, IPR2021-00920 (filed May 21, 2021); *LG Electronics, Inc. et al. v. Gesture Technology Partners, LLC*, IPR2022-00091 (filed November 5, 2021).

D. The Effective Priority Date of Claims 1-31 of the '431 Patent

For purposes of this reexamination only, Requester assumes that claims 1-31 are entitled to the claimed priority date of July 8, 1999, listed on the cover of the '431 patent. (Ex. PAT-A, Cover.)

Liebermann issued on November 9, 1999, from Application No. 08/653,732 filed May 23, 1996; *Harakawa* issued on May 7, 2002, from Application No. 09/040,436 filed March 18, 1998; *Maruno* issued on February 20, 2001, from Application No. 08/945,628 filed January 2, 1998; *Maguire* issued on July 1, 1997, from Application No. 25,975 filed March 3, 1993; and *Mack* issued on March 6, 2001, from Application No. 09/123,965 filed July 29, 1998. Thus, *Lieberman*, *Harakawa*, *Maruno*, *Maguire*, and *Mack* qualify as prior art at least under pre-AIA 35 U.S.C. § 102(e).

Pinkney issued on August 26, 1980, from Application No. 14,207 filed February 22, 1979, and thus qualifies as prior art at least under pre-AIA 35 U.S.C. §§ 102(b) and (e).

IV. Claim Construction

In a reexamination proceeding involving claims of an expired patent, claim construction pursuant to the principle set forth by the court in *Phillips v. AWH Corp.*, 415 F.3d 1303, 1316, 75 USPQ2d 1321, 1329 (Fed. Cir. 2005) (words of a claim "are generally given their ordinary and customary meaning" as understood by a person of ordinary skill in the art in question at the time of the invention) should be applied since the expired claim[s] are not subject to amendment. MPEP

[2] *See supra* n.1; *infra* Section V.F.1.

§ 2258 I.(G) (citing *Ex parte Papst-Motoren*, 1 USPQ2d 1655 (Bd. Pat. App. & Inter. 1986)). The '431 patent, which lists July 7, 2000, as the date of the earliest related continuation and does not list any term extensions or adjustments, has expired. (*See* Ex. PAT-A, Cover.) Therefore, the claim interpretations submitted or implied herein for the purpose of this reexamination adhere to the *Phillips* standard. *See In re CSB-System Int'l, Inc.*, 832 F.3d 1335, 1340-42 (Fed. Cir. 2016).[3]

The district court in the related Eastern District of Texas cases recently construed/considered several terms recited in the claims of the '431 patent under the *Phillips* standard. (Ex. CC-3.) A summary of the district court constructions/interpretations and the constructions advanced by the parties in the litigation is listed in the below table.

'431 Patent Terms	E.D. Texas Construction	Construction Advanced by Defendant(s)	Construction Advanced by PO
"electro-optically sensing" of claim 1	plain meaning (Ex. CC-3, 38-41)	"sensing [light reflected from said at least one finger] by measuring changes to an electric field" (Ex. CC-3, 38-41)	no construction necessary (Ex. CC-3, 38-41)
"electro-optical sensing" of claim 2	plain meaning (Ex. CC-3, 38-41)	"sensing light reflected from said at least one finger by measuring changes to an electric field" (Ex. CC-3, 38-41)	no construction necessary (Ex. CC-3, 38-41)
"wherein said movement is sensed in 3 dimensions" of claim 4	"wherein said movement is determined in 3 dimensions" (Ex. CC-3, 35-37)	"wherein said movement is determined with respect to three perpendicular axes"	no construction necessary (Ex. CC-3, 35-37)

[3] Requester reserves all rights to raise claim constructions and other arguments in other venues. For example, Requester has not necessarily raised all challenges to the '431 patent in this proceeding, including those under 35 U.S.C. § 112, given the limitations placed by the Rules governing this proceeding. For example, Requester has alleged some terms are indefinite in district court proceedings. But given how closely the prior art maps to the claims (as explained below), those issues do not need to be resolved to assess patentability in this proceeding. In addition, a comparison of the claims to any accused products in litigation may raise controversies that need to be resolved through claim construction that are not presented here given the similarities between the references and the '431 patent. Thus, the SNQs presented herein should not be interpreted to (and do not) conflict with Requester's indefiniteness positions in other proceedings regarding the '431 patent (and how the Court ruled on such positions) (Ex. CC-3).

'431 Patent Terms	E.D. Texas Construction	Construction Advanced by Defendant(s)	Construction Advanced by PO
		(Ex. CC-3, 35-37)	
"a camera means associated with said housing for obtaining an image using reflected light of at least one object positioned by a user operating said object" of claim 7	N/A; agreed term (Ex. CC-3, 9)	"a camera associated with said housing for obtaining an image using reflected light of at least one object positioned by a user operating said object" (Ex. CC-3, 9)	"a camera associated with said housing for obtaining an image using reflected light of at least one object positioned by a user operating said object" (Ex. CC-3, 9)
"a light source for illuminating said object" of claim 12	plain meaning (Ex. CC-3, 32-35)	"a light source designed to transmit light directly onto said object" (Ex. CC-3, 32-35)	no construction necessary (Ex. CC-3, 32-35)
"wherein said information is obtained in 3 dimensions" of claim 19	plain meaning (Ex. CC-3, 37-38)	"wherein said information is obtained with respect to three perpendicular axes" (Ex. CC-3, 37-38)	no construction necessary (Ex. CC-3, 37-38)
"sensing means associated with said device" of claim 1	"sensor associated with said device" (Ex. CC-3, 26-28)	term invokes 35 U.S.C. § 112 ¶ 6: function = "electro-optically sensing light reflected from said at least one finger"; structure = "a camera" (Ex. CC-3, 26-28)	no construction necessary and not governed by 35 U.S.C. § 112 ¶ 6; alternatively, if terms do invoke 35 U.S.C. § 112 ¶ 6: function = "electro-optically sensing light reflected from at least one finger"; structure = "electro-optical sensor" (Ex. CC-3, 26-28)
"computer means within said housing for analyzing said image to determine information	plain meaning (Ex. CC-3, 16-23)	term invokes 35 U.S.C. § 112 ¶ 6: function = "analyzing said image to determine	no construction necessary and not governed by 35 U.S.C. § 112 ¶ 6; alternatively, if terms

'431 Patent Terms	E.D. Texas Construction	Construction Advanced by Defendant(s)	Construction Advanced by PO
concerning a position or movement of said object" of claim 7		information concerning a position or movement of said object [positioned by a user operating said object]"; structure = "A computer programmed to (1) scan the pixel elements in a matrix array on which said image is formed, and then calculate the centroid location 'x,y' of a target on the object using the moment method disclosed in U.S. Patent No. 4,219,847 to Pinkney, as disclosed at 4:48–62; (2) add or subtract said image from prior images and identify movement blur, as disclosed at 6:64–7:14, 7:22–29; (3) obtain a time variant intensity change in said image from the detected output voltage from the signal conditioning of the camera means or by subtracting images and observing the difference due to such variation, as disclosed at 8:25–38; or (4) detect a change in color reflected from a diffractive, refractive, or	do invoke 35 U.S.C. § 112 ¶ 6:: function = "analyzing said image to determine information concerning a position or movement of an object"; structure = "a computer with at least one microprocessor specially programmed programed [sic] to determine information concerning a position or movement of said object" (Ex. CC-3, 16-23)

'431 Patent Terms	E.D. Texas Construction	Construction Advanced by Defendant(s)	Construction Advanced by PO
		interference based element on said object that reflects different colors during movement, as disclosed at 8:60–9:14." (Ex. CC-3, 16-23)	
"means for controlling a function of said apparatus using said information" of claim 7	terms invoke 35 U.S.C. § 112 ¶ 6: function = "controlling a function of said handheld computer apparatus using said information concerning a position or movement of said object positioned by a user operating said object"; structure = "a control system programmed to control a function based on information concerning a position or movement of said object; and equivalents thereof" (Ex. CC-3, 10-15)	term invokes 35 U.S.C. § 112 ¶ 6: function = "controlling a function of said [handheld computer] apparatus using said information [concerning a position or movement of said object positioned by a user operating said object]" and dependent claims asserted by PO further add to the function such as the object is a finger; structure = indefinite[4] (Ex. CC-3, 10-15)	Term is governed by 35 U.S.C. § 112 ¶ 6: function = "controlling a function of said apparatus using said information"; structure = "a control system associated with a camera" (Ex. CC-3, 10-15)
"display function which is controlled" of claim 9	plain meaning (Ex. CC-3, 23-25)	term invokes 35 U.S.C. § 112 ¶ 6: function = "controlling a display function"; structure =	no construction necessary and not governed by 35 U.S.C. § 112 ¶ 6; (Ex. CC-3, 23-25)

[4] While the district court declined to find this term indefinite, Requester does not concede the claim is definite by demonstrating how the prior art discloses/suggests this limitation below. Instead, as noted, Requester presents how a substantial new question of patentability is raised by the prior art where the term is interpreted under the district court's (and PO's) interpretations of the claimed term, and also as construed below.

'431 Patent Terms	E.D. Texas Construction	Construction Advanced by Defendant(s)	Construction Advanced by PO
		"a computer programmed to (1) move a slider on the display as disclosed at 13:54–67, (2) turn a knob on the display as disclosed at 13:63–14:9, or (3) throw a switch on the display as disclosed at 13:63–13:67" (Ex. CC-3, 23-25)	
"means for transmitting information" of claim 11	terms invoke 35 U.S.C. § 112 ¶ 6: function = "transmitting information"; structure = "a cell phone, and equivalents thereof" (Ex. CC-3, 29-32)	term invokes 35 U.S.C. § 112 ¶ 6: function = "transmitting information"; structure = "cellular transceiver" (Ex. CC-3, 29-32)	term is governed by 35 U.S.C. § 112 ¶ 6: function = "transmitting information"; structure = "a transmitter" (Ex. CC-3, 29-32)

The prior art mappings found in Section V of this Request explain how the claims of the '431 patent are unpatentable under the constructions of the district court as well as the constructions advanced by both PO and Defendants. Indeed, the claims would be unpatentable under any reasonable construction of the terms given how closely the prior art maps to the claims. More generally, Section V demonstrates how the prior art meets the limitations of the challenged claims under their plain meaning (as adopted by the district court) unless otherwise noted. Specific information regarding disputed terms in the Eastern District of Texas litigation concerning the '431 patent follows.

A. "electro-optically sensing" of claim 1

The Defendants have contended that the above limitation should be construed to mean "sensing [light reflected from said at least one finger] by measuring changes to an electric field."

(Ex. PAT-A, FIG. 17A, 3:15-22, 11:54-58, 17:4-14, 23:58-65, claim 1.) Requester demonstrates below in Section V how the prior art addresses this limitation under this interpretation.

PO has contended that the above limitation does not require construction. (Ex. CC-1, 7; Ex. CC-2, 14-15.) Requester likewise demonstrates below in Section V how the prior art addresses this limitation under PO's interpretation, which also reflects the plain meaning given by the district court's construction order. (Ex. CC-3, 38-41.)

B. "electro-optical sensing" of claim 2

The Defendants have contended that the above limitation should be construed to mean "sensing light reflected from said at least one finger by measuring changes to an electric field." (Ex. PAT-A, FIG. 17A, 3:15-22, 11:54-58, 17:4-14, 23:58-65, claim 2.) Requester demonstrates below in Section V how the prior art addresses this limitation under this interpretation.

PO has contended that the above limitation does not require construction. (Ex. CC-1, 7-8; Ex. CC-2, 14-15.) Requester likewise demonstrates below in Section V how the prior art addresses this limitation under PO's interpretation, which also reflects the plain meaning given by the district court's construction order. (Ex. CC-3, 38-41.)

C. "wherein said movement is sensed in 3 dimensions" of claim 4

The Defendants have contended that the above limitation should be construed to mean "wherein said movement is determined with respect to three perpendicular axes." (Ex. PAT-A, FIG. 1B, 3:53-60, claim 4.) Requester demonstrates below in Section V how the prior art addresses this limitation under this interpretation.

PO has contended that the above limitation does not require construction. (Ex. CC-1, 7; Ex. CC-2, 14.) The district court construed the above limitation to mean "wherein said movement is determined in 3 dimensions." (Ex. CC-3, 35-37.) Requester likewise demonstrates below in Section V how the prior art addresses this limitation under both PO's interpretation (i.e., plain meaning) and the district court's construction order.

D. "a camera means associated with said housing for obtaining an image using reflected light of at least one object positioned by a user operating said object" of claim 7

The Defendants have contended that the above phrase should not be construed according to 35 U.S.C. § 112, ¶ 6. Instead, the above limitation should be construed to mean "a camera associated with said housing for obtaining an image using reflected light of at least one object positioned by a user operating said object." (Ex. PAT-A, claim 7.) PO agreed on this construction in district court. (Ex. CC-1.) The district court acknowledged this agreed construction in its construction order. (Ex. CC-3, 9.) Requester demonstrates below in Section V how the prior art addresses this limitation under this interpretation.

E. "a light source for illuminating said object" of claim 12

The Defendants have contended that the above limitation should be construed to mean "a light source designed to transmit light directly onto said object." (Ex. PAT-A, FIGS. 1A, 3C, 4B, 3:23-43, 8:4-14, 9:1-8, claim 12.) Requester demonstrates below in Section V how the prior art addresses this limitation under this interpretation.

PO has contended that the above limitation does not require construction. (Ex. CC-1, 6; Ex. CC-2, 13.) Requester likewise demonstrates below in Section V how the prior art addresses this limitation under PO's interpretation, which also reflects the plain meaning mapping warranted by the district court's construction order. (Ex. CC-3, 32-35.)

F. "wherein said information is obtained in 3 dimensions" of claim 19

The Defendants have contended that the above limitation should be construed to mean "wherein said information is obtained with respect to three perpendicular axes." (Ex. PAT-A, FIG. 1B, 3:53-60, claim 19.) Requester demonstrates below in Section V how the prior art addresses this limitation under this interpretation.

PO has contended that the above limitation does not require construction. (Ex. CC-1, 7; Ex. CC-2, 14.) Requester likewise demonstrates below in Section V how the prior art addresses this limitation under PO's interpretation, which also reflects the plain meaning given by the district court's construction order. (Ex. CC-3, 37-38.)

G. Claim terms construed according to 35 U.S.C. § 112, ¶ 6

The Defendants have contended that the below phrases should be construed according to 35 U.S.C. § 112, ¶ 6. While the district court has not construed all of the below terms according to 35 U.S.C. § 112, ¶ 6, Requester offers the below constructions in the event terms are found to

be subject to 35 U.S.C. § 112, ¶ 6 (under the assumption the Office determines appropriate structure is provided in the '431 patent for all the below terms, which Requester does not concede for certain term(s)).

Construing a means-plus-function claim term requires that the function recited in the claim term be first identified; then, the written description of the specification must be consulted to identify the corresponding structure that performs the identified function and equivalents thereof. *See Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1351 (Fed. Cir. 2015); *see also Gracenote, Inc. v. Iceberg Indus., LLC*, IPR2013-00551, Paper No. 6 at 15 (Feb. 28, 2014).

A structure disclosed in the specification qualifies as corresponding structure only if it is clearly linked by the patent's specification (or possibly the prosecution history) to performing the claimed function. *See Default Proof Credit Card Sys., Inc. v. Home Depot U.S.A., Inc.*, 412 F.3d 1291, 1298 (Fed. Cir. 2005). Where a means-plus-function term is directed to software, the specification must "disclose an algorithm for performing the claimed function." *Williamson*, 792 F.3d at 1352.

1. "sensing means associated with said device" of claim 1

The district court construed this limitation to mean "sensor associated with said device" and to not invoke 35 U.S.C. § 112, ¶ 6. (Ex. CC-3, 26-28.) PO had also argued in district court that this "sensing means" does not invoke 35 U.S.C. § 112, ¶ 6, but proposed that the limitation did not require construction. (Ex. CC-1, 4-5; Ex. CC-2, 11-12.) Requester demonstrates below in Section V how the prior art addresses this limitation under these interpretations.

To the extent this limitation is found to be subject to 35 U.S.C. § 112, ¶ 6, Requester proposes the following construction.

The identified function is "electro-optically sensing light reflected from said at least one finger." (Ex. PAT-A, FIGS. 1A, 4A, 3C, 10A, 3:44-52, 7:22-25, 8:4-8, 16:10-15, claim 1.)

The corresponding structure is "a camera" and its equivalents. (*Id.*)

Requester demonstrates below in Section V how the prior art addresses this limitation under this interpretation.

Alternatively, PO argues that if the district court finds this phrase to be subject to 35 U.S.C. § 112, ¶ 6, the identified function is "electro-optically sensing light reflected from at least one finger" and the corresponding structure is an "electro-optical sensor." (*Id.*)

Under both PO's 35 U.S.C. § 112, ¶ 6 interpretation, Requester likewise demonstrates below in Section V how the prior art addresses the limitations.

2. "computer means within said housing for analyzing said image to determine information concerning a position or movement of said object" of claim 7

PO had argued in district court that this "computer means" does not require construction and does not invoke 35 U.S.C. § 112, ¶ 6. (Ex. CC-1, 2-4.) Requester demonstrates below in Section V how the prior art addresses the limitation under PO's interpretation, which also reflects the plain meaning given by the district court's construction order. (Ex. CC-3, 16-23.)

To the extent this limitation is found to be subject to 35 U.S.C. § 112, ¶ 6, Requester proposes the following construction.

The identified function is "analyzing said image to determine information concerning a position or movement of said object [positioned by a user operating said object]." (Ex. PAT-A, claim 7.) The dependent claims currently asserted by Plaintiff further add to the function, including: (1) wherein said object is a finger (Claim 8). (*Id.*, claim 8.)

The corresponding structure is "a computer programmed to (1) scan the pixel elements in a matrix array on which said image is formed, and then calculate the centroid location "x,y" of a target on the object using the moment method disclosed in U.S. Patent No. 4,219,847 to Pinkney, as disclosed at 4:48-62 [of the '431 patent]; (2) add or subtract said image from prior images and identify movement blur, as disclosed at 6:64-7:14, 7:22-29 [of the '431 patent]; (3) obtain a time variant intensity change in said image from the detected output voltage from the signal conditioning of the camera means or by subtracting images and observing the difference due to such variation, as disclosed at 8:25-38 [of the '431 patent]; or (4) detect a change in color reflected from a diffractive, refractive, or interference based element on said object that reflects different colors during movement, as disclosed at 8:60-9:14 [of the '431 patent]," and its equivalents. (Ex. PAT-A, 3:63-4:4, 4:9-4:28, 4:48-462, 6:64-7:29, 8:4-38, 8:60-9:14.)

Requester demonstrates below in Section V how the prior art addresses this limitation under this interpretation.

Alternatively, PO argued that if the district court finds this phrase to be subject to 35 U.S.C. § 112, ¶ 6, the identified function is "analyzing said image to determine information concerning a position or movement of an object" and the corresponding structure is "a computer with at least

one microprocessor specially programmed [] to determine information concerning a position or movement of said object." (Ex. CC-1, 2-3.) PO later proposed in district court that the corresponding structure is "a computer" and described the identified function as "analyzing to determine" or "analyzing said image to determine information concerning a position or movement of an object." (Ex. CC-2, 6-10.) Under all of PO's interpretations, Requester likewise demonstrates below in Section V how the prior art addresses the limitations.

3. "means for controlling a function of said apparatus using said information" of claim 7

The district court construed the above phrase according to 35 U.S.C. § 112, ¶ 6. The district court identified the function as "controlling a function of said handheld computer apparatus using said information concerning a position or movement of said object positioned by a user operating said object" and the corresponding structure as "a control system programmed to control a function based on information concerning a position or movement of said object; and equivalents thereof." (Ex. CC-3, 10-15.) Accordingly, Requester demonstrates below in Section V how the prior art addresses this limitation.

To the extent this limitation is found to be subject to 35 U.S.C. § 112, ¶ 6, Requester proposes the following construction (under the assumption the Office determines appropriate structure is provided in the '079 patent, which Requester does not concede).

The identified function is "controlling a function of said [handheld computer] apparatus using said information [concerning a position or movement of said object positioned by a user operating said object]." (Ex. PAT-A, FIG. 8, 11:53-13:44, claim 7.) The dependent claims currently asserted by Plaintiff further add to the function, including: (1) wherein said object is a finger (Claim 8). (*Id.*, claim 8.)

As discussed above, where a means-plus-function term is directed to software, the specification must "disclose an algorithm for performing the claimed function." *Williamson*, 792 F.3d at 1352. For purposes of this proceeding only, Requester interprets the corresponding structure of the above-identified function as software running on a processor configured to performed the identified function or equivalents thereof given the lack of relevant disclosure in the '431 patent specification. (*See also supra* footnote 2.).

Requester demonstrates below in Section V how the prior art addresses this limitation under this interpretation.

PO initially argued in district court that the above phrase should be construed according to 35 U.S.C. § 112, ¶ 6, that the identified function is "controlling a function of said apparatus using said information," and that the corresponding structure is "a computer with at least one microprocessor specially programmed for controlling said apparatus using said information." (Ex. CC-1, 7.) PO later proposed that the corresponding structure is "a control system associated with a camera." (*Id.*) Under both of PO's interpretations, Requester likewise demonstrates below in Section V how the prior art addresses this limitation.

4. "display function which is controlled" of claim 9

PO had argued in district court that this "display function" does not require construction and does not invoke 35 U.S.C. § 112, ¶ 6. (Ex. CC-1, 4.) Requester demonstrates below in Section V how the prior art addresses this limitation under PO's interpretation, which also reflects the plain meaning mapping warranted by the district court's construction order. (Ex. CC-3, 23-25.)

To the extent this limitation is found to be subject to 35 U.S.C. § 112, ¶ 6, Requester proposes the following construction.

The identified function is "controlling a display function." (Ex. PAT-A, claim 9.)

The corresponding structure is "a computer programmed to (1) move a slider on the display as disclosed at 13:54-67 [of the '431 patent], (2) turn a knob on the display as disclosed at 13:63-14:9 [of the '431 patent], or (3) throw a switch on the display as disclosed at 13:63-13:67 [of the '431 patent]," and its equivalents. (*Id.*, 13:54-67.)

Requester demonstrates below in Section V how the prior art addresses this limitation under this interpretation.

5. "means for transmitting information" of claim 11

The district court construed the above phrase according to 35 U.S.C. § 112, ¶ 6. The district court identified the function as "transmitting information" and the corresponding structure as "a cell phone, and equivalents thereof." (Ex. CC-3, 29-32.) Accordingly, Requester demonstrates below in Section V how the prior art addresses this limitation.

To the extent this limitation is found to be subject to 35 U.S.C. § 112, ¶ 6, Requester proposes the following construction (under the assumption the Office determines appropriate structure is provided in the '079 patent, which Requester does not concede).

The identified function is "transmitting information." (Ex. PAT-A, claim 11.)

The corresponding structure is a "cellular transceiver" and its equivalents. (*Id.*, 12:65-13:3.)

Requester demonstrates below in Section V how the prior art addresses this limitation under this interpretation.

PO had argued in district court that the above phrase should be construed according to 35 U.S.C. § 112, ¶ 6, that the identified function is "transmitting information," and that the corresponding structure is a "transmitter." (Ex. CC-1, 11-12.) Under PO's interpretation, Requester likewise demonstrates below in Section V how the prior art addresses the limitations.

V. Statement of Substantial New Questions of Patentability

As mentioned above (and below (Section V.F.1)), *Liebermann*, *Harakawa*, *Maruno*, *Maguire*, *Mack*, and *Pinkney* were never considered as asserted prior art by the Office during original prosecution. But the references (in various combinations for respective claims, as discussed below) disclose or suggest all of the features of claims 1-31.

SNQ1: *Liebermann* raises a substantial new question of patentability (SNQ1) with respect to claims 1-9, 11-21, 25-26, and 28-31 of the '431 patent.

SNQ2: *Liebermann* in view of *Harakawa* raises a substantial new question of patentability (SNQ2) with respect to claim 20 of the '431 patent.

SNQ3: *Liebermann* in view of *Maruno* raises a substantial new question of patentability (SNQ3) with respect to claims 9, 10, 22, and 23 of the '431 patent.

SNQ4: *Liebermann* in view of *Maruno* and *Maguire* raises a substantial new question of patentability (SNQ4) with respect to claim 24 of the '431 patent.

SNQ5: *Liebermann* in view of *Mack* raises a substantial new question of patentability (SNQ5) with respect to claims 10, 23, and 27 of the '431 patent.

SNQ6: *Liebermann* in view of *Pinkney* raises a substantial new question of patentability (SNQ6) with respect to claims 7-9 and 11-13 of the '431 patent.

SNQ7: *Liebermann* in view of *Pinkney* and *Maruno* raises a substantial new question of patentability (SNQ7) with respect to claims 9 and 10 of the '431 patent.

SNQ8: *Liebermann* in view of *Pinkney* and *Mack* raises a substantial new question of patentability (SNQ8) with respect to claim 10 of the '431 patent.

Thus, for these reasons and the reasons discussed below and in the accompanying declaration of Dr. Abowd (Ex. PA-DEC), the above grounds raise substantial new questions of patentability with respect to the '431 patent. (*See also* Ex. PA-DEC, ¶¶ 1-38.) Proposed rejection 1, discussed below in Section VI.B.1, corresponds to SNQ1; proposed rejection 2, discussed below in Section VI.B.2, corresponds to SNQ2; proposed rejection 3, discussed below in Section VI.B.3, corresponds to SNQ3; proposed rejection 4, discussed below in Section VI.B.4, corresponds to SNQ4; proposed rejection 5, discussed below in Section VI.B.5, corresponds to SNQ5; proposed rejection 6, discussed below in Section VI.B.6, corresponds to SNQ6; proposed rejection 7, discussed below in Section VI.B.7, corresponds to SNQ7; and proposed rejection 8, discussed below in Section VI.B.8, corresponds to SNQ8.

A. SNQ1: *Liebermann*

As explained below and in the attached declaration of Dr. Abowd (Ex. PA-DEC), *Liebermann* discloses or suggests the limitations of claims 1-9, 11-21, 25-26, and 28-31 of the '431 patent. (Ex. PA-DEC, ¶¶ 63-66, 88-161.)

1. Overview of *Liebermann*

Liebermann discloses "a novel electronic communication system" and "a unique method utilizing such an electronic communication system to enable communication by and to deaf persons." (Ex. PA-1, 3:11-24.) FIG. 6 discloses a cellular telephone that serves as a "portable transmitter/receiver generally designated by the numeral 8 for use by a deaf person," which "contains a video camera, the lens 10 of which is disposed in the upright portion 12. In the base portion 13 are an LCD display panel 14 and a key pad 16 for dialing and other functions." (*Id.*, FIG. 6, 4:21-22, 5:62-67.) The cellular phone also has an antenna 18 to allow wireless communication "through a cellular telephone network." (*Id.*, 5:67-6:2.) The visual display of the cellular phone may "present multiple [types of] information to the deaf person such as touchless function buttons, system status indicators, alarms, a printed translation, and a playback of the

image being recorded, as well as the signing images and text of the hearing person's responses." (*Id.*, 6:31-36.) FIG. 6 of *Liebermann* is reproduced below.

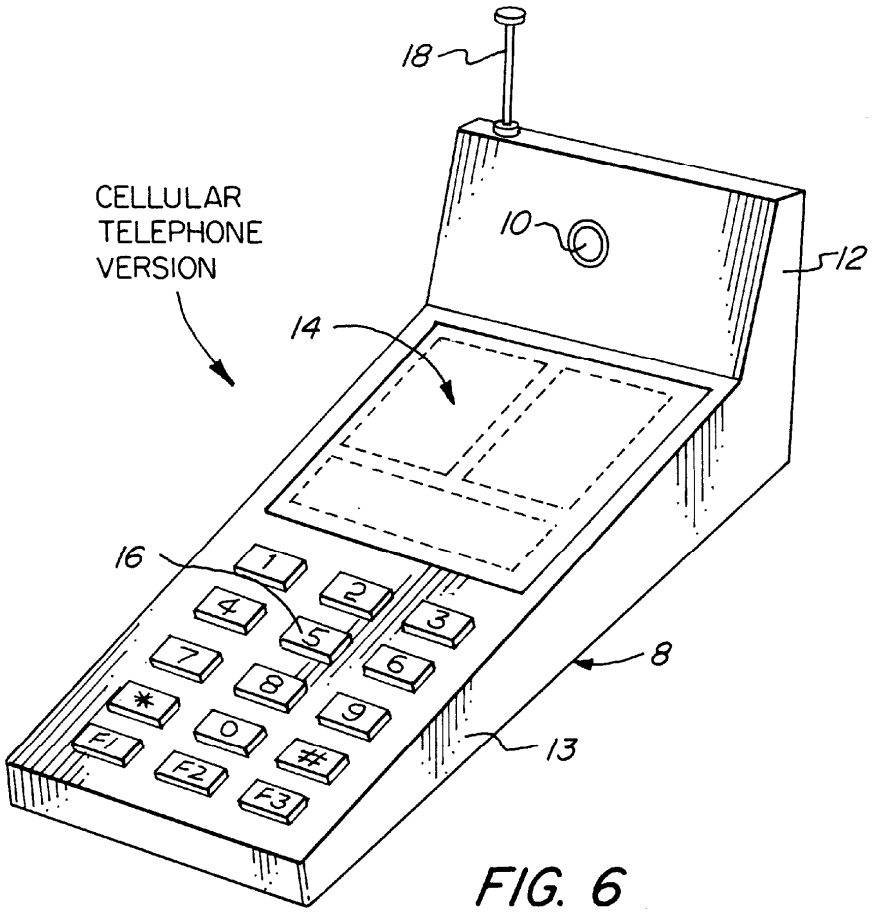


FIG. 6

(*Id.*, FIG. 6.)

In order to communicate through the device, "[t]he device is supported in a stable position and the deaf person is positioned so that the camera lens 10 will record the signing movement of the hands and fingers and body and facial motions and expressions." (*Id.*, 6:2-6.) "The signing motions captured by the camera are converted into digital data for processing by the translation software." (*Id.*, 6:6-8.) "In the initial processing, each of the frames containing a captured image undergoes a process whereby the image is collapsed into a small set of fixed identifiers." (*Id.*, 6:47-49.) The resulting information is then sent via a phone line to a central data processing, where "[t]he rest of the processing is completed." (*Id.*, 6:50-53.) "This includes identification of the letters, numbers and words, conversion to standard sign language, and the conversion to spoken language which results in the equivalent text of the signed content." (*Id.*, 6:53-57.) The text is

then converted to synthesized speech and sent to the hearing person on the other end of the phone line. (*Id.*, 6:53-63.) A hearing person's responsive speech is sent to the central processing center, where it is "transformed into the equivalent signing content and then into textual material." (*Id.*, 7:10-12.) The resulting data is then sent back to the signing user's device, where "[s]oftware in the device converts the text into reduced identifying pointers for each gesture, which are then converted into animated images which portray in sign language the content of the speech processed in the center." (*Id.*, 12-17.) "The result is an animated content on the LCD of the [signing person's device] which portrays in sign language the spoken content of the normally hearing person." (*Id.*, 7:41-43.)

Liebermann additionally discloses detailed algorithms for translating sign language to spoken content, and converting speech back to sign language. (*Id.*, 7:44-9:27 (disclosing an algorithm for figure tracking for use in the sign language to speech translation), 9:28-10:53 (disclosing an algorithm for increasing accuracy of speech recognition and conversion to digital data).) *Liebermann* provides helpful schematics as well that illustrate the methods for "converting signing into speech" (FIG. 9) and converting "text to signing animation" (FIG. 11), as well as more specific illustrations of "translation of American Sign Language to English text" (FIG. 16) and "translation of English text to American Sign Language (ASL)" (FIG. 15). (*Id.*, FIGS. 9, 11, 15, 16.) FIG. 9, which illustrates conversion of signing to speech and thus handles most of the gesture recognition in *Liebermann*, is reproduced below.

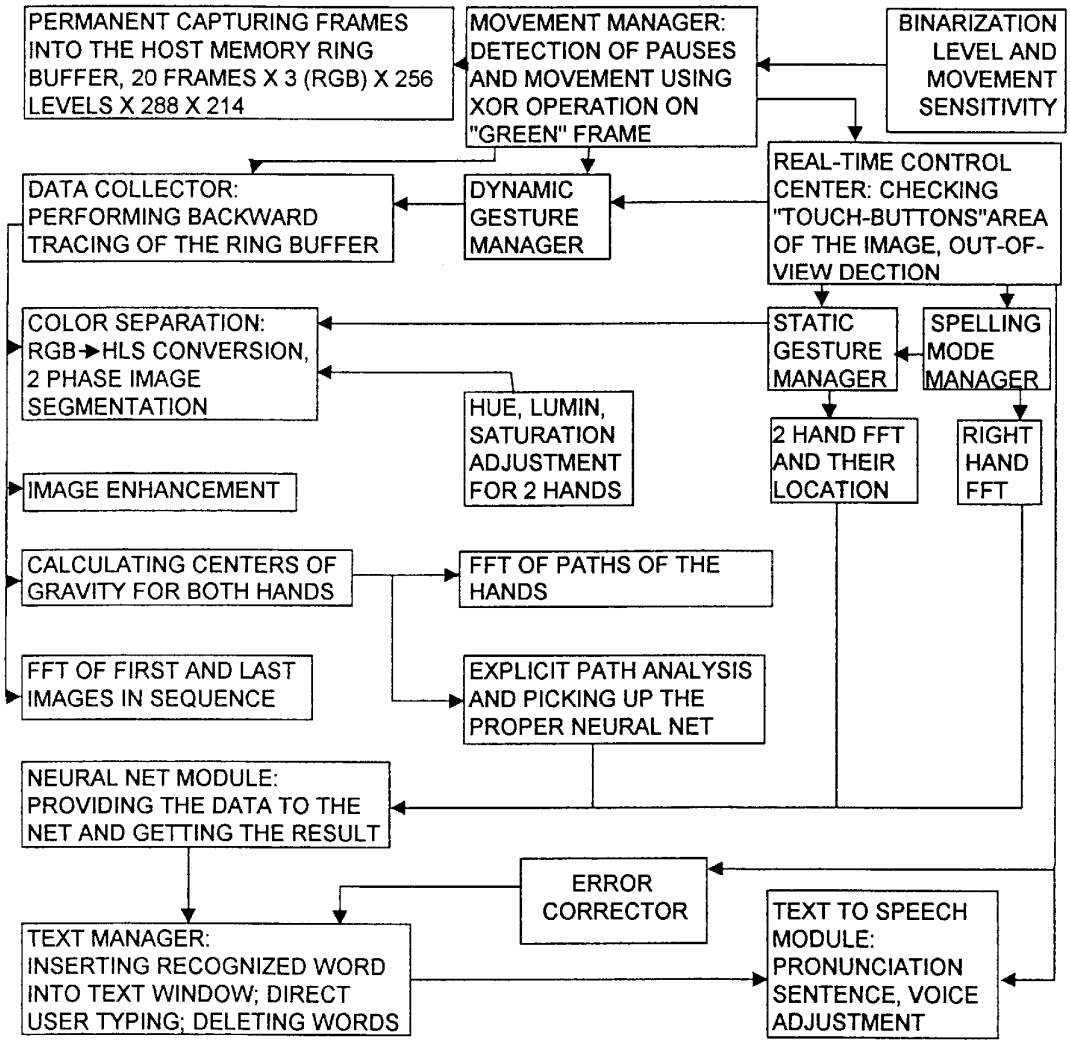


FIG. 9

(*Id.*, FIG. 9.)

Because *Liebermann* relates to personal computing devices that perform optical sensing of human inputs, *Liebermann* is in the same or similar technical field as the '431 patent, and a POSITA would have had reason to consider the teachings of *Liebermann*. (*Supra* Section III.A; Ex. PA-DEC, ¶¶ 63-66.) To the extent *Liebermann* is not within the field of endeavor of the '431 patent, *Liebermann* is reasonably pertinent to problems associated with optically sensing and detecting human inputs/gestures using personal computing devices, problems with which the inventor was involved. (*Supra* Section III.A; Ex. PA-DEC, ¶¶ 63-66.)

2. Claim 1

As explained below, *Liebermann* discloses or suggests the limitations recited in claim 1. (Ex. PA-DEC, ¶¶ 89-114.)

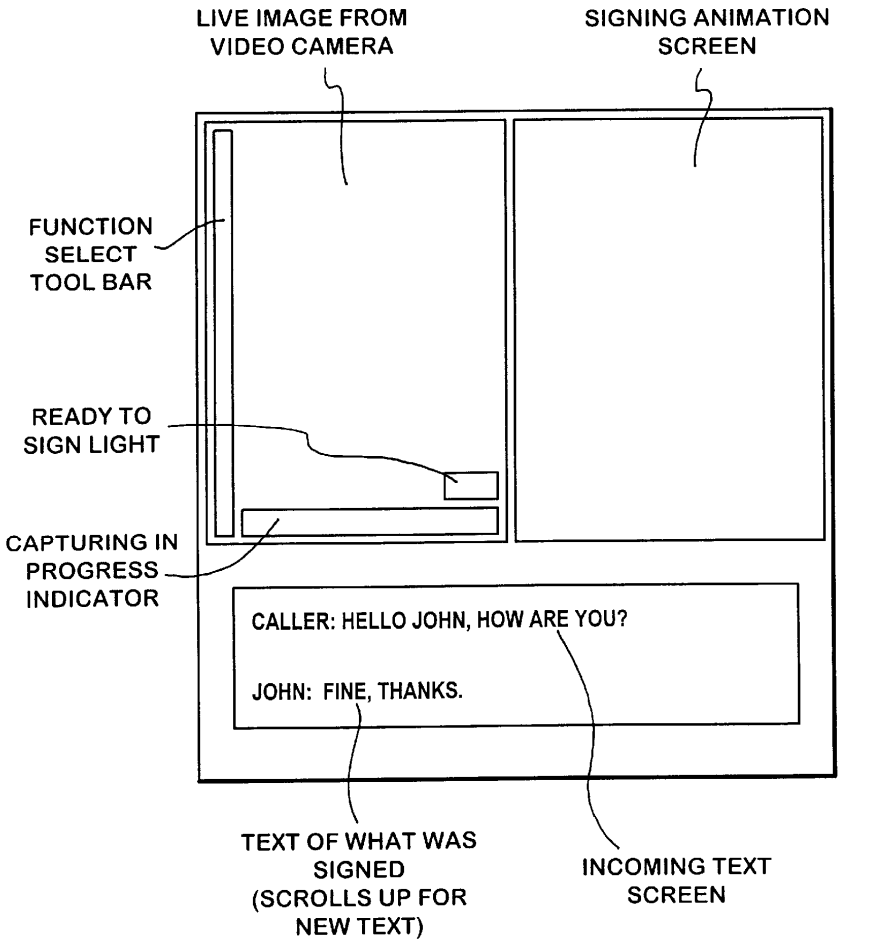
a. [1.a] A method for controlling a handheld computing device comprising the steps of:

Liebermann discloses or suggests this preamble to the extent limiting. (Ex. PA-DEC, ¶¶ 89-100.) *Liebermann* discloses a "portable transmitter/receiver," as shown in FIG. 6, that is in the "form of a cellular telephone." (Ex. PA-1, 4:21-22, 5:62-63.) A person of ordinary skill in the art (POSITA) would have understood that this cellular phone is handheld and contains a computer within the cellular phone frame, and is therefore a "handheld computing device." (Ex. PA-DEC, ¶ 90.) In particular, *Liebermann* discloses that the cellular telephone includes hardware that works with a camera to view and obtain images of hand signs (i.e., one's gestures), performs related "initial processing," and populates a phone display, among other things. (Ex. PA-1, 5:62-6:10, 6:40-52, FIG. 8; Ex. PA-DEC, ¶ 90.) Specifically, the cellular telephone performs functions that a POSITA would have understood to be "computing" functions performed by a computer, such as controlling cameras, driving a display, transmitting information, receiving information, processing data, etc. (*Id.*, 5:62-6:47, FIGs 1, 8.) The cellular phone also has a video camera, an LCD display, a key pad, and "an antenna 18 for the device so that it may be transported and communicate as a wireless remote or through a cellular telephone network." (*Id.*, 5:62-6:2.)

Through this wireless connection, the cellular phone performs local computer processing in conjunction with a remote "dedicated central computer facility" to "provide a novel electronic communication system for use by deaf persons to enable them to communicate by signing" as well as "a unique method utilizing such an electronic communication system to enable communication by and to deaf persons." (*Id.*, 3:11-13, 3:22-24, 5:62-6:14; Ex. PA-DEC, ¶ 90.) In particular, *Liebermann* discloses that "[t]he device is supported in a stable position and the deaf person is positioned so that the camera lens 10 will record the signing movement of the hands and fingers and body and facial motions and expressions"—that is, the signs that comprise the communicated sign language, such as ASL. (*Id.*, 6:2-6, 10:54.) During a number of processing steps that occur in the device and at a central processing center, the communicated signing motions are translated to speech and then conveyed to the receiving hearing user in either verbal or written form. (*Id.*,

6:6-14, 6:37-63.) A hearing person's responsive speech is then sent to the central processing center and then the device, with portions of the processing for speech to ASL translation occurring at both the center and the device. (*Id.*, 7:10-17.)

Liebermann further discloses that the above-discussed method for electronic communication is also a method for controlling the FIG. 6 handheld computing device. (Ex. PA-DEC, ¶ 92.) For instance, *Liebermann* discloses that, to enhance the performance of the electronic communication method, the cellular phone displays a variety of information for the deaf user, including "touchless function buttons, system status indicators, alarms, a printed translation, and a playback of the image being recorded, as well as the signing images and text of the hearing person's responses." (*Id.*, 6:31-36.) These elements of the LCD display are shown in FIG. 8, which is reproduced below. (*Id.*, FIG. 8.)



TELEPHONE FOR THE DEAF VIDEO MONITOR SCREEN LAYOUT

FIG. 8

(*Id.*, FIG. 8.)

A POSITA would have understood that the disclosed electronic communication method *controls* the handheld computing device in a couple ways. (Ex. PA-DEC, ¶ 93.)

First, by signing in view of the cellular phone's camera while capturing is in progress, the deaf user is able to control the signing content that the device processes, conveys to the central processing center and then to the hearing user, and displays on the deaf user's device as translated text in the lower portion of the display. (*Id.*, ¶ 94; Ex. PA-1, FIG. 8 (showing the area of the device screen that displays the text of the signed content).) The sign that is performed is the same sign that the cellular phone processes, transmits, and displays as text in real-time. (Ex. PA-DEC, ¶ 94; Ex. PA-1, 6:2-14 (describing the translation process), FIG. 8 (showing the text display on the

cellular phone), 12:7-29 (describing the method's real-time transmission).) The method thereby allows control of *what* content the device processes, transmits, and displays, as well as *when* the content is processed, transmitted, and displayed. (Ex. PA-DEC, ¶ 94.)

Second, the deaf user may control the device by using the "touchless function buttons," which a POSITA would have understood are found on the "function select tool bar" in FIG. 8 and could include a variety of gestures or predetermined signs to select each function button. (Ex. PA-DEC, ¶ 95; Ex. PA-1, FIG. 8, 6:31-36.) *Liebermann* discloses a number of system settings, such as a "ready to sign light," "capturing in progress indicator," "system status indicators, alarms, a printed translation, and a playback of the image being recorded, as well as the signing images and text of the hearing person's responses." (Ex. PA-1, FIG. 8, 6:31-36.) A POSITA would have understood that selecting a touchless function button would allow a user to control the cellular phone by instructing the phone to perform the desired function, such as those functions disclosed by *Liebermann* and described above. (Ex. PA-DEC, ¶ 95.) To the extent *Liebermann* does not expressly disclose that the touchless function buttons are used to control these functions, it would have been obvious to modify *Liebermann* in this manner. (*Id.*) Specifically, a POSITA would have been motivated to modify the *Liebermann* cellular phone so that the touchless function buttons control cellular phone settings related to the system status indicators, alarms, translation, and playback—i.e., the functions that the *Liebermann* cellular phone is already capable of performing. (*Id.*) A POSITA would have had a reasonable expectation of success in implementing this modification in the *Liebermann* cellular phone because such a modification would have involved implementing *Liebermann*'s own touchless function buttons to control functions that *Liebermann* discloses are performed by the cellular phone. (*Id.*; Ex. PA-1, 6:31-36.) Accordingly, such a modification would have involved applying known technologies (e.g., known cellular phone touchless function button technology) according to known methods (e.g., known functions for cellular phone control) to yield the predictable result of a cellular phone with touchless function buttons which are used to control the cellular phone through control of various phone functions. (Ex. PA-DEC, ¶ 95.) Thus, for the reasons discussed above, *Liebermann* discloses or suggests a "method for controlling a handheld computing device." (*Id.*, ¶ 95.)

As discussed above, while *Liebermann* discloses that the cellular phone performs "initial processing," among other things, it also discloses that aspects of the computer processing in the method for controlling the device occur on a network server. (*Id.*, ¶ 96.) To the extent *Liebermann*

is read to not disclose that the FIG. 6 cellular phone is a handheld *computing* device, this feature would have been obvious in view of the state of the art. (*Id.*) For example, it would have been obvious to perform all processing steps, including the initial processing and the gesture recognition processing, locally on a computer incorporated within the cellular phone. (*Id.*) *See In re Yufa*, 452 F. App'x. 998, 1001 (Fed. Cir. 2012) (citing *KSR Intern. Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007)) (affirming obviousness because the prior art disclosed "every element of the claims except" the location for "the processing of" data, which was "nothing more than a reconfiguration of a known system"). Indeed, *Liebermann* itself suggests that the location where processing occurs is a matter of design choice. Specifically, *Liebermann* discloses that it uses a network computer to process gesture information because it is "economical[]" to do so. (Ex. PA-1, 6:10-12; *see also id.*, 3:38-42 ("From cost and portability standpoints, the translating means is at a remote location or central station.").) While a network computer was an economic solution envisioned by *Liebermann* (*id.*, 6:10-12), a POSITA would have understood that other processing options were also available, and that there would have been reasons motivating such alternatives. (Ex. PA-DEC, ¶ 96.)

For instance, it was well known at the time of the invention to incorporate a computer within a cellular phone or other portable housings in order to handle a variety of sophisticated processing tasks. (*See* Ex. PA-11, 5:19-29 (disclosing in *Himmel* a "[c]omputing platform 300 . . . located within a cell phone" where the computing platform (computer) also "includes a CPU 302, which may be an embedded processor or processor such as a Pentium processor from Intel Corporation"), 5:42-63 (disclosing that the *Himmel* computer is of a small form factor that is capable of running a Windows operating system and performing a variety of complex processes, such as processing voice commands, electronic documents, display information, etc.); *see also* Ex. PA-12, 18:11-12 (disclosing in *Sears* a "computer located in the main system 35"), 18:9-15 (disclosing that the *Sears* main system 35 is "engaged in the analysis of images"), 7:1-7 ("The main system 35 computer should be of sufficient power to perform . . . the process. In general, any Intel Pentium or compatible chip of 150 MHz speed will be sufficient . . ."), 20:65-21:33 (describing portable reading machines which include the *Sears* computer, and describing how the computer is carried in various other portable means, "including backpacks, hip packs, shoulder bags or an article of clothing such as a vest").) A POSITA would have understood that these internal computers, which as described above would be integrated in a cellular phone and would

include a processor chip, were "capable of running a variety of application software packages," such as text and/or image editors, web browsers, calculators, and others at the time of invention. (Ex. PA-14, 1:12–24, 8:2–6; *see also* Ex. PA-15, 1:43–2:18 (citing the Nokia 9000 as a smart phone that included a small keyboard, a specialized web browser, and a small VGA monitor); Ex. PA-DEC, ¶ 97.) Indeed, at the time of the alleged invention, it was known that "[m]obile computing technology . . . allow[s] the individual to access computer related information at all times and in all environments." (Ex. PA-15, 1:44-48.) For instance, a mobile computer, e.g., "[a] PDA allowed a user to access computer related information, yet fitted in the palm of the hand." (*Id.*, 1:49-50.) Furthermore, a POSITA would have understood that "more integration in mobile computing is desired." (*Id.*, 2:3-4; Ex. PA-DEC, ¶ 97.) "By utilizing computer technology, users or callers have access to computing functions and resources in a personal, portable device." (Ex. PA-11, 1:24-27.) Additionally, at the time of the alleged invention, it was known to "integrat[e] . . . personal computer technology into phones." (*Id.*, 1:22-24; *see also id.*, 1:22-52 (discussing various types of personal computer technology integration with cellular phones), 2:31-46 (explaining that the present invention integrates personal computer technology into cellular phones by "provid[ing] a method and apparatus for using electronic documents within a smart phone").) In this fashion, a POSITA would have understood that, at the time of the alleged invention, smart phones could at least possess the processing/computing capability of personal computers. (*Id.*; Ex. PA-DEC, ¶ 97.) Thus, a POSITA would have similarly understood that these processors, described above, would have provided a cellular telephone, similar to as discussed in *Liebermann*, the capability of performing the gesture recognition portions of the *Liebermann* method for "controlling a handheld computing device." (*Id.*)

A POSITA would have found it obvious to include a computer, similar to as described above in the state of the art, within the cellular phone to perform all of the required gesture recognition processing in order to provide a more integrated phone and conserve bandwidth. (Ex. PA-DEC, ¶ 98.) *Liebermann* discloses altering where processing occurs based on the strength of the user's device and the transmission line. (Ex. PA-1, 5:25-30 (disclosing modifications to portions of the speech-to-sign processing based on the strength of "the transmission line and computer capability of the deaf person's location").) *Liebermann* also discloses that the choice to perform the initial processing (conversion of signs to an intermediate set of fixed identifiers) in the cellular phone and the remaining processing (conversion of identifiers to text, and text to

speech) in the central processing facility is a design choice driven by economics. (*Id.*, 6:10-12.) Furthermore, *Liebermann* discloses that the disclosed device can function as "an ***on-site*** translator" rather than just a telephone for the deaf. (*Id.*, 13:37-39.) Thus, a POSITA would have understood that all processing could feasibly take place in the cellular phone in order to implement the *Liebermann* method. (Ex. PA-DEC, ¶ 98.)

A POSITA would have considered the design tradeoffs in configuring the above modification (including, for example, the benefits of providing a more integrated cellular phone device and conservation of bandwidth with any additional costs and form factor adjustments to accommodate such changes), and in view of such considerations would have nonetheless been motivated to implement the modification. (Ex. PA-DEC, ¶ 99.) Indeed, any potential increase in implementation cost to provide a local processing capability does not foreclose a finding of obviousness here. *See In re Farrenkopf*, 713 F.2d 714, 718 (Fed. Cir. 1983) (finding additional expense associated with a particular combination would not discourage one of ordinary skill in the art from seeking the benefit expected therefrom). Given that, at the time of the alleged invention, it was becoming "more and more pervasive" to integrate "personal computer technology into phones," a POSITA would have understood that the software-driven features for gesture recognition could have been implemented on those phones having the requisite computing power to operate those features. (Ex. PA-11, 1:23-25; Ex. PA-DEC, ¶ 99.) A POSITA would have been motivated to do so as it would have provided additional features and applications to the then-existing cellular phone after-market. (Ex. PA-DEC, ¶ 99.) Furthermore, as a POSITA would have understood, the proposed modification would have reduced network communication demands because the cellular telephone could communicate with another individual directly instead of through an intervening network computer, and would have improved user convenience because it would not require communication with a remote processing center that could require additional telecommunication bandwidth. (*Id.*) In fact, *Liebermann* discloses that consideration of network communication demands is important, emphasizing that the decision to reduce frames to fixed identifiers is because of bottlenecks in transmitting video data over telephone lines. (Ex. PA-1, 12:7-29.) A POSITA would have understood that the proposed modification to perform all processing locally would reduce network communication demands even further. (Ex. PA-DEC, ¶ 99.) Thus, a POSITA would have been motivated to implement *Liebermann* modified processes such that the processing for the "identification of the letters, numbers and words" was fully

performed by the cellular phone (claimed "determining . . . the movement of said finger," rather than an intermediate determination of fixed identifier data). (Ex. PA-1, 6:42-52; Ex. PA-DEC, ¶ 99.)

A POSITA would have had a reasonable expectation of success in implementing this modification because it would have involved modifying the *Liebermann* communication system in a manner that *Liebermann* suggests is feasible—adapting which portions of the processing occur in the cellular phone or the processing center. (Ex. PA-DEC, ¶ 100.) A POSITA would have also had the skill to implement, and expectation of success in achieving such a modification because it would have involved applying known technologies (e.g., known gesture detection technology (*Liebermann*) and known cellular phone computers (state of the art)) according to known methods (e.g., adapting the processing so that some of the processing responsibilities of a processing center are instead given to the local device (*Liebermann*)) to yield the predictable result of a cellular phone with an internal computer that performs additional processing capabilities. (*Id.*) *See KSR Intern. Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007). Thus, to the extent *Liebermann* is read to not disclose that the cellular phone is a handheld *computing* device, a POSITA would have found it obvious for the above reasons to implement a computer within the cellular phone in order to have the phone perform the entire "method for controlling a handheld computing device." (Ex. PA-DEC, ¶ 100.)

b. [1.b] holding said device in one hand;

Liebermann discloses or suggests this limitation. (Ex. PA-DEC, ¶¶ 101-105.) *Liebermann* discloses that during electronic signing communication, the cellular phone "is supported in a stable position and the deaf person is positioned so that the camera lens 10 will record the signing movement of the hands and fingers and body and facial motions and expressions." (Ex. PA-1, 6:2-6.) While *Liebermann* does not explicitly disclose that the cellular phone in a stable position includes "holding said device in one hand," a POSITA would have found it obvious to implement *Liebermann* to allow the user to perform the method with one hand. (Ex. PA-DEC, ¶ 101.) A POSITA would have recognized that implementing *Liebermann* to allow a user to hold the device in one hand and perform the method with the other is beneficial for a number of reasons. (*Id.*)

First, *Liebermann* discloses a number of one-handed signing features, for which a POSITA would have understood that handheld usage would be desirable. (Ex. PA-DEC, ¶ 102.)

Liebermann discloses detection of ASL signs via an "ASL to English translation algorithm," and notes that implementing the disclosed ASL to English translation method requires "linguistic analysis beyond what was recognized by William Stokoe in [Semiotics] and Human Sign Language, Mouton (197[2]), and Sign Language Structure, Linstok Press (1978)." (*Id.*, 10:54-56, 12:3-6; *see also* Exs. PA-7, PA-8.) A POSITA would have understood that implementing the disclosed *Liebermann* method in the cellular phone would require consulting Stokoe's sign language publications and ensuring that, at a minimum, the cellular phone performs the disclosed *Liebermann* method to the full extent of those publications. (Ex. PA-DEC, ¶ 102.) In *Semiotics and Human Sign Language*, Stokoe notes that "one particular one-hand manual alphabet is known and used by those who also use American Sign Language." (Ex. PA-7, 21, FIG. 1 (showing diagrams of the one-handed American Manual Alphabet which is used in ASL).) Because *Liebermann* discloses an entire range of signs that only require one hand, a POSITA would have recognized that it would be advantageous for the device to function in a handheld capacity with one hand holding the device and the other hand performing finger spelling. (Ex. PA-DEC, ¶ 102.)

Second, *Liebermann* discloses that the device has "touchless function buttons," which a POSITA would have understood would have been useful as mechanisms to turn the device on or control various settings, such as those relating to the "system status indicators, alarms," translation, and playback. (*Id.*, ¶ 103; Ex. PA-1, 6:31-36.) In light of *Liebermann*'s disclosures and guidance, a POSITA would have understood that the touchless function buttons in such a sign language translation and communication device would have been implemented using ASL signs or similar gestures. (Ex. PA-DEC, ¶ 103.) Indeed, using a variety of hand gestures to implement touchless buttons or functions in personal computing technology was well known before the time of the invention. (Ex. PA-16, Abstract (describing how a hand in three predetermined configurations may be used to execute a cursor and cursor "pick" function" in a computer system with video camera input), 4:27-29 ("The computer 10 is provided with display screen circuitry 40 . . . which is operative to display on the screen 38 a cursor 42 and a selectable icon 44."), 5:41-45 ("the three hand configurations . . . are merely representative of many alternate hand configurations that could be used to perform the illustrated cursor control functions"); Ex. PA-12, Abstract (describing a gesture recognition and control system using personal computing technology, such as "alternative device configurations [that] allow portable operation"), 3:19-21 (disclosing that the present invention "provide[s] a system to permit users to designate text to be read and to specify control

system parameters through manual gestures"), 10:16-30 (describing how "gestural movements could be used not only to select the text to be read, but also the manner in which the text output should be generated, or other parameters of the electronic reading process"); Ex. PA-3, 2:24-26 ("a virtual switch or the like displayed on the display screen can be selected by the hand gesture").) Furthermore, a POSITA would have recognized that it would have been advantageous to use one-handed gestures for these function buttons to enable the user to easily adjust device settings *while* holding the device in one hand. (*Id.*, ¶ 103.)

Third, a POSITA would have understood the portability advantages of being able to use the *Liebermann* cellular phone with one hand. (*Id.*, ¶ 104.) A POSITA would have recognized that a user may want to take advantage of the portable nature of the cellular phone and perform the Liebermann method while holding the device in one hand—for example, if the user is not able to set the device down, or if the user desires the flexibility and freedom of movement that a portable device provides. (*Id.*) Such functionality would greatly increase the environments in which a deaf user could communicate via the *Liebermann* cellular phone device. (*Id.*)

Thus, a POSITA would have motivated to implement the *Liebermann* method so that the user may hold the device in one hand and perform the method with the other hand. (*Id.*, ¶ 105.) A POSITA would have had a reasonable expectation of success in implementing this modification in the *Liebermann* phone because *Liebermann* already discloses processing that isolates one hand from the others. (*See* Ex. PA-1, FIG. 9 (showing a "right hand FFT" performed as part of the translation process), 7:49-9:28 (disclosing a feature tracking algorithm that isolates the left and right hands); Ex. PA-DEC, ¶ 105.) A POSITA would have had the skill to implement, and expectation of success in achieving such a modification because it would have involved applying known technology (e.g., known cellular phone-based gesture detection technology) according to known methods (e.g., known methods of isolating single hand movements) to yield the predictable result of a cellular phone that can be held in the user's hand and implement a one-hand version of the *Liebermann* method. (Ex. PA-DEC, ¶ 105.) *See KSR Intern. Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007).

c. [1.c] moving at least one finger in space in order to signal a command to said device;

Liebermann discloses or suggests this limitation. (Ex. PA-DEC, ¶¶ 106-108.) *Liebermann* discloses that performing signs involves "moving at least one finger in space." In particular, *Liebermann* discloses that the device camera records the "signing *movement* of the hands and *fingers*" and that the "images captured by the camera are of the *finger* and hand *motions*." (Ex. PA-1, 6:2-6, 6:43-47.) As discussed for claim 1.a in Section V.A.2.a, the *Liebermann* method discloses signing in view of the camera in order to control the signing content the device processes, transmits, and displays. (Section V.A.2.a.) In particular, the *Liebermann* method allows for control via signing of *what* content the cellular phone processes, transmits, and displays, as well as *when* the content is processed, transmitted, and displayed. (*Id.*) A POSITA would have recognized that when a user signs, that sign also serves as a signal or instruction to the cellular phone (i.e., a command) to process, transmit, and display the same content contained in the sign. (Ex. PA-DEC, ¶ 106.) Thus, when a deaf user signs, the user "signal[s] a command to said device" to process, transmit, and display the same content contained in the "command." (*Id.*) Because these signs involve moving at least one finger, *Liebermann* discloses "moving at least one finger in space in order to signal a command to said device."

As also discussed for claim 1.a, the *Liebermann* method discloses controlling the device by using "touchless function buttons" found on the "function select tool bar" of the device. (Section V.A.2.a.) A POSITA would have understood that selecting a touchless function button would "signal a command to said device" to perform the selected function. (Ex. PA-DEC, ¶ 107.) While *Liebermann* does not explicitly disclose that the touchless function buttons are selected by "moving at least one finger in space," a POSITA would have found it obvious to modify the *Liebermann* method so that the touchless function buttons are selected using a sign, series of signs, or similar gestures—i.e., the same gestures that the *Liebermann* method is already capable of detecting. (*Id.*) As discussed in Section V.A.2.b, it was well known before the time of the invention to implement touchless function or button technology in personal computing devices, so a POSITA would have understood that similar gestures—such as the ASL signs detected by the *Liebermann* communication method—would be well suited for implementing touchless function buttons as well. (*Id.*; Section V.A.2.b.) A POSITA would have understood that any of those same signs, or a combination thereof, would be appropriate for implementing the touchless function buttons. (Ex. PA-DEC, ¶ 107.) Furthermore, a POSITA would have recognized that the sheer

number and variety of signs the *Liebermann* system can detect would allow great variety and control in implementing touchless function buttons to perform a range of desired tasks. (*Id.*)

As discussed above, such signs involve "moving at least one finger in space." (*Id.*, ¶ 108.) A POSITA would have had a reasonable expectation of success in implementing this modification in the *Liebermann* cellular phone because such a modification would have involved selection of *Liebermann*'s touchless function buttons using sign language and/or gestures detected based on *Liebermann*'s own sign/gesture detection method, as discussed for claim 1(c). (*See, e.g.*, Ex. PA-1, 5:62-7:43 (disclosing using the cellular phone to effect translation of signs); Section V.A.2.a; Ex. PA-DEC, ¶ 108.) Accordingly, such a modification would have involved applying known technologies (e.g., known gesture detection technology) and materials (e.g., known touchless function buttons) according to known methods (e.g., known sign language detection techniques) to yield the predictable result of a cellular phone with touchless function buttons on the display which are selected (thereby signaling a command to the device) using sign language or similar gestures. (Ex. PA-DEC, ¶ 108.)

d. [1.d] electro-optically sensing light reflected from said at least one finger using a sensing means associated with said device;

Liebermann discloses or suggests this limitation. (Ex. PA-DEC, ¶ 109.) Under the district court's construction, *Liebermann* discloses a sensing means or "sensor associated with said device"—specifically, a camera, which the district court suggested was a specific type of sensor. (Section IV.G.1; Ex. CC-3, 28.) Likewise, when construed under 35 U.S.C. § 112, ¶ 6, *Liebermann* discloses "a camera" or its equivalents (Requester's proposed construction) and discloses or suggests an "electro-optical sensor" (PO's alternative construction). (Section IV.G.1.) In particular, *Liebermann* discloses that the cellular phone device has an associated "***video camera***, the lens 10 of which is disposed in the upright portion 12." (Ex. PA-1, 5:62-65.) The camera "record[s] the signing movement of the hands and *fingers* and body and facial motions and expressions." (*Id.*, 6:2-6.) A POSITA would have understood that a video camera is a "sensing means" or "electro-optical sensor" that "electro-optically sens[es] light reflected from" the object it is capturing by measuring changes to an electric field in order to sense the reflected light. (Section IV.A; Ex. PA-DEC, ¶ 109.) In fact, it was well known at the time of the invention that a

video camera is a sensing means that records an object by electro-optically sensing light from said object. (Ex. PA-DEC, ¶ 109; *see, e.g.*, Ex. PA-9, 1:11-16 ("An electro-optical sensor is a device that converts radiant energy of a particular wavelength or range of wavelengths into an electrical signal. One example of an electro-optical sensor is a handheld TV camera, which converts images of visible light into an electrical signal that can be stored in electronic memory or displayed on a television screen."); Ex. PA-10, 1:23-28 (demonstrating the state of art and explaining "the electro-optical sensor which is usually a TV camera . . .").) Thus, a POSITA would have understood that the associated camera is a "sensing means associated with said device" that "electro-optically sens[es] light reflected from said at least one finger." (Ex. PA-DEC, ¶ 109; Section IV.G.1.)

Accordingly, *Liebermann* discloses or suggests this limitation under the Requester's proposed constructions, the interpretations proposed by PO, and those found by the district court, such as those regarding "electro-optically sensing" and "sensing means associated with said device," or the plain meaning of such terms. (*See* Sections IV.A, IV.G.1.)

e. [1.e] determining from said sensed light the movement of said finger, and

Liebermann discloses or suggests this limitation. (Ex. PA-DEC, ¶¶ 110-113.) *Liebermann* discloses that the electronic communication method involves determining the movement of a finger based on a camera image because the electronic communication method uses the camera's recorded gesture output as the input for the translation process which determines the meaning of these movements. When using the *Liebermann*'s cellular phone, shown in FIG. 6, "[t]he device is supported in a stable position [or held in one hand, as discussed for claim 1.b] and the deaf person is positioned so that the *camera lens 10 will record the signing movement of the hands and fingers and body and facial motions and expressions*. The *signing motions captured by the camera are converted into digital data for processing by the translation software*, (i.e., artificial intelligence) to produce data representing numbers, words and phrases which are then combined into coherent sentences." (Ex. PA-1, 6:2-10.) This translation process involves initial processing in the cellular phone, where "each of the frames containing a captured image undergoes a process whereby the image is collapsed into a small set of fixed identifiers," as well as additional processing at the central processing center (or within the modified cellular phone, as discussed in Section V.A.2.a), where the identifiers are interpreted as "letters, numbers and words" and converted to "standard

sign language" and then to "spoken language which results in the equivalent text of the signed content." (*Id.*, 6:42-63; *see also id.*, 4:64-5:2 (disclosing that the set of identifiers resulting from initial processing is "in the form of tables of numbers").)

While the *Liebermann* method relies on a frame-by-frame analysis of captured images, a POSITA would have recognized from *Liebermann*'s disclosures that the method does not merely determine the meaning of isolated hand positions. (Ex. PA-DEC, ¶ 111.) Instead, the *Liebermann* method must sense and determine the *movement* of a finger or hand as it forms various signs, because as *Liebermann* explains, such movement is not just a way to connect isolated hand positions—the motion can convey meaning. (*Id.*) For example, *Liebermann* discloses that when a user signs in ASL, articulating a certain word or meaning may involve "combin[ing] information about the handshape [an isolated hand position] (Stokoe's 'dez'), the motion [of the hand] (Stokoe's 'sig') and the spatial location of the hands relative to the rest of the body (Stokoe's 'tab')." (Ex. PA-1, 1:54-67 (internal quotations added).) *Liebermann* further discloses that the method can identify certain movements as transitional gestures, rather than movements that are part of a single gesture. (*Id.*, FIG. 1 (disclosing that the captured frames are reduced to identifier data *after* a gesture start and end frame is determined), FIG. 11 (disclosing that the *Liebermann* method contains a "transition dictionary" which is used, for example, to connect previous and current gestures when displaying signing animation of a hearing user's responsive speech).) Thus, a POSITA would have recognized that the *Liebermann* method senses and determines the *movement* of a finger or hand as it forms various signs in order to accurately determine whether the movement is a transitional gesture, *or* whether it is part of a single gesture and must be further analyzed for meaning. (Ex. PA-DEC, ¶ 111.) Furthermore, *Liebermann* discloses analysis of individual frames in conjunction with other frames in order to perform the gesture recognition processing. (Ex. PA-1, FIG. 9 (disclosing, for example, that the gesture recognition process requires calculation of a "FFT [fast Fourier transform] of first and last images in sequence").) A POSITA would have recognized that in order to distinguish transitional movements from meaningful movements, the *Liebermann* method requires analysis of individual frames in conjunction with, and in the context of, other frames to determine movement. (Ex. PA-DEC, ¶ 111.)

Thus, for the reasons described above, a POSITA would have understood that the entire translation process to determine the meaning of signed hand positions, gestures, and movements

relies on the video camera's recording of signed movements, where frames with captured images can be isolated and analyzed in conjunction with, and in the context of, other frames. (*Id.*, ¶ 112.) As discussed above for claim 1.d, a POSITA would have further understood that since the method involves determining from *captured images of the finger* the movement of that finger, it also involves "determining from said sensed light the movement of said finger." (*Id.*)

A POSITA would have understood that such a determination is necessary for both communicating via the cellular phone and using the touchless function buttons (i.e., the two ways of controlling the cellular phone, as discussed in Section V.A.2.a) because, as described for claim 1.c in Section V.A.2.c, a POSITA would have found it obvious to implement the touchless function buttons using one or more ASL signs. (Sections V.A.2.a, V.A.2.c; Ex. PA-DEC, ¶ 113.) Thus, "determining from said sensed light the movement of said finger" would be required in both communication and touchless function buttons contexts because in either case, translation of various signs in combination with one another would be necessary to ascertain the meaning of the communicated language or communicated button function. (Ex. PA-DEC, ¶ 113.) Similar movement sensing/determination, as described in the dependent claims, is applicable to both contexts as well for the similar reasons to those described here. (*Id.*)

f. [1.f] using said sensed finger movement information, controlling said device in accordance with said command.

Liebermann discloses or suggests this limitation. (Ex. PA-DEC, ¶ 114.) *Liebermann* discloses this limitation for similar reasons as discussed for claims 1.a, 1.c, and 1.e. (Sections V.A.2.a, V.A.2.c, V.A.2.e.) As discussed for claim 1.c, the control functions discussed for claim 1.a—controlling the signing content the device processes, conveys, and displays, as well as controlling the device through touchless function buttons—involve commands initiated by a deaf user's finger movement. (Sections V.A.2.a, V.A.2.c.) As also discussed, both of these functions may involve the determination of known signs and finger movements. (Sections V.A.2.a, V.A.2.c.) Section V.A.2.e describes how this determination of sensed finger movement information occurs using the *Liebermann* method. (Section V.A.2.e.) Thus, for the reasons discussed above for this claim, a POSITA would have understood that when a finger movement (sign) is sensed and determined during the method, this either *controls* which information the deaf user's cellular phone transmits to the hearing user and displays as translated text on the deaf user's

display, or *controls* functions of the cellular phone (e.g., a function relating to system status indicators, alarms, translation, or playback, among other system settings, as described in Section V.A.2.a) according to a known touchless function button. (Ex. PA-DEC, ¶ 114; Sections V.A.2.a-e.) *Liebermann* therefore discloses or suggests "using said sensed finger movement information [to] control[] said device in accordance with said command."

3. Claim 2

a. A method according to claim 1, wherein at least one camera is utilized to effect said electro-optical sensing.

Liebermann discloses or suggests the limitations recited in claim 2. (Ex. PA-DEC, ¶ 115.) *Liebermann* discloses or suggests these limitations for the reasons explained for claim 1.d, which also demonstrates how *Liebermann* discloses at least one camera is utilized to effect said electro-optical sensing like that recited in claim 2. (Section V.A.2.d.) For the same reasons as explained for claim 1.d, *Liebermann* discloses or suggests this limitation under the Requester's proposed construction, and the plain meaning proposed by PO and found by the district court for the claimed "electro-optical sensing." (*See* Sections IV.A-B.)

4. Claim 3

a. A method according to claim 1, including the further step of acquiring an image of at least a portion of the user of the device.

Liebermann discloses or suggests the limitations recited in claim 3. (Ex. PA-DEC, ¶ 116.) *Liebermann* discloses or suggests these limitations for similar reasons to those explained for claim 1.c, which describes how the cellular phone's camera acquires an image of the deaf user's fingers and other portions of the user's body like that recited in claim 3. (Section V.A.2.c.)

5. Claim 4

a. A method according to claim 1, wherein said movement is sensed in 3 dimensions.

Liebermann discloses or suggests the limitations recited in claim 4. (Ex. PA-DEC, ¶¶ 117-118.) *Liebermann* discloses that "three dimensional video cameras have been developed" and

"[t]he use of such devices may facilitate recognition of signing motions by enhancing spatial differences." (Ex. PA-1, 13:29-31.) A POSITA would have understood that a three-dimensional video camera senses movement in three dimensions—more specifically, with respect to three perpendicular axes. (Ex. PA-DEC, ¶ 117; *see* Section IV.C.) While *Liebermann* does not disclose that the cellular phone features such a three-dimensional camera, a POSITA would have found it obvious to modify the *Liebermann* cellular phone to include such a three-dimensional camera in order to allow for sensing, and further determining (*see* Section V.A.2.e), of movement in three dimensions. (*Id.*, ¶ 117.) A POSITA would have been motivated to implement a three-dimensional camera that senses movement in three dimensions in light of *Liebermann*'s disclosure that these cameras may beneficially "enhance[] spatial differences," *Liebermann*'s disclosures that ASL signs often incorporate motion, and *Liebermann*'s reference to sign language publications by William Stokoe that provide additional information on the "sig" (motion) component of signs. (Ex. PA-1, 13:29-31 (discussing "enhancing spatial differences" with a three-dimensional camera), 12:3-6 (disclosing an "ASL to English translation algorithm" as shown in FIG. 16 to translate a deaf user's signs to a hearing user), 10:59-67 (disclosing that when signing in ASL, "[a]t any particular instant, one has to combine information about the handshape (Stokoe's 'dez'), the *motion (Stokoe's 'sig')* and the spatial location of the hands relative to the rest of the body (Stokoe's 'tab')" (internal quotations added)), 10:54-56 (disclosing that implementing the *Liebermann* ASL to English translation method would require "linguistic analysis beyond what was recognized by William Stokoe in [Semiotics] and Human Sign Language, Mouton (197[2])" (*see* Ex. PA-7)); Ex. PA-7, 23 (providing an example of the "sig" of a sign, noting that "the 'sig' of the sign for [letter] *z* is a movement which traces a *z* with the fingertip" (internal quotations added)), 37 (providing a table of "sig" symbols, including for example "upward movement" and "downward movement"); Ex. PA-DEC, ¶ 117.) In particular, Stokoe notes in a table of "sig" (motion) components of a sign that a particular sign may involve "upward movement," "downward movement," "rightward movement," "leftward movement," "movement toward signer," or "movement away from signer," which a POSITA would have understood to be the *x*, *y*, and *z* directions. (Ex. PA-7, 37.) Thus, a POSITA would have understood the benefit of modifying the *Liebermann* method of sensing and determining movement with the cellular phone's camera to implement a three-dimensional camera to sense and determine movement in three dimensions.

(Ex. PA-DEC, ¶ 117; Section IV.C; *see also* Section V.A.2.e (describing the *Liebermann* method's capability to *determine* movement).)

A POSITA would have had a reasonable expectation of success in implementing this modification in the *Liebermann* cellular phone because *Liebermann* discloses that such a modification is both possible and beneficial. (Ex. PA-1, 13:29-31; Ex. PA-DEC, ¶ 118.) Moreover, a POSITA would have had the skill to implement, and expectation of success in achieving such a modification because it would have involved applying known technology (e.g., known movement/gesture detection technology) and materials (e.g., known three-dimensional cameras) according to known methods (e.g., known three-dimensional movement sensing) to yield the predictable result of a cellular phone with a three-dimensional camera that uses the *Liebermann* sign detection and device control method to sense movement of a deaf user's finger in three dimensions. (Ex. PA-DEC, ¶ 118.) *See KSR Intern. Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007).

Accordingly, *Liebermann* discloses or suggests this limitation under the Requester's proposed construction, the plain meaning proposed by PO, and the construction found by the district court regarding the claimed "wherein said movement is sensed in 3 dimensions." (*See* Section IV.C.)

6. Claim 5

a. A method according to claim 1, wherein movement of one finger relative to another finger is sensed.

Liebermann discloses or suggests the limitations recited in claim 5. (Ex. PA-DEC, ¶¶ 119-121.) As described for claim 1.b, a POSITA would have understood that implementing the disclosed *Liebermann* method in the cellular phone requires consulting both of the incorporated sign language publications by Stokoe and ensuring that the cellular phone performs the method to the full extent of those publications. (Section V.A.2.b.) A POSITA would have therefore understood that to sense (and determine) the full range of required finger movement (*see* Section V.A.2.e (describing how the *Liebermann* method must sense/determine all movements in order to properly categorize by movement type)), the sensed movements would have to include the information *Liebermann* discloses via these incorporated Stokoe publications. (Ex. PA-DEC, ¶ 119.)

Liebermann discloses with reference to these Stokoe publications that ASL signs combine information about the handshape (Stokoe's 'dez'), *the motion (Stokoe's 'sig')* and the spatial location of the hands relative to the rest of the body (Stokoe's 'tab')." (Ex. PA-1, 10:54-67 (internal quotations added).) A POSITA would have understood, therefore, that the "sig" (motion) component of an ASL sign conveys meaning. (Ex. PA-DEC, ¶ 120.) In *Semiotics and Human Sign Languages*, Stokoe discloses a variety of "sig" motions that involve the movement of one finger relative to another finger. (*Id.*; Ex. PA-7.) For example, Stokoe discloses that the "sig" of a sign may involve a "wiggling action of fingers," a "nodding or bending action," or a "linking action" ("grasp"). (Ex. PA-7, 37.) Wiggling of the fingers involves "[s]mall actions of the fingers singly or in rapid sequence," which a POSITA would have recognized is a relative movement between fingers. (*Id.*, 39; Ex. PA-DEC, ¶ 120.) A nodding or bending action requires a different sort of relative movement—for example, "in the sign translating 'you and I' the dez [handshape] is [letter] V or K held so that nodding sig alternately points the second finger at signer and the index at addressee," as if in a "to and fro motion." (Ex. PA-7, 39; Ex. PA-DEC, ¶ 120.) The linking/grasping "sig," however, involves the relative movement of the thumb and index/middle finger in a pinching or plucking motion. (Ex. PA-7, 41; Ex. PA-DEC, ¶ 120.) A POSITA would have understood that the *Liebermann* method must be capable of sensing (and also *determining*) such "movement[s] of one finger relative to another" because, as described above, each "sig" component of a sign—including those that feature relative finger movements—contributes to the meaning of the signed word. (Ex. PA-DEC, ¶ 120.)

To the extent *Liebermann* does not disclose these gestures found in the incorporated publications, a POSITA would have found it obvious to modify the *Liebermann* method in view of *Liebermann*'s disclosures regarding these fundamental sign language texts. (Ex. PA-DEC, ¶ 121.) A POSITA would have been motivated to implement detection of the ASL signs and features described by Stokoe with the *Liebermann* method because, as described above, (i) *Liebermann* discloses detection of ASL as a preferred sign language, (ii) *Liebermann* discloses that detection of ASL requires linguistic analysis beyond what is described by Stokoe's publications, and (iii) Stokoe's publications disclose fundamental features of ASL sign formation. (*Id.*) A POSITA would have also had a reasonable expectation of success in implementing this modification because it would have involved implementing detection of additional signs using well-known methods for similar sign detection. (*Id.*) A POSITA would have had the skill to implement, and

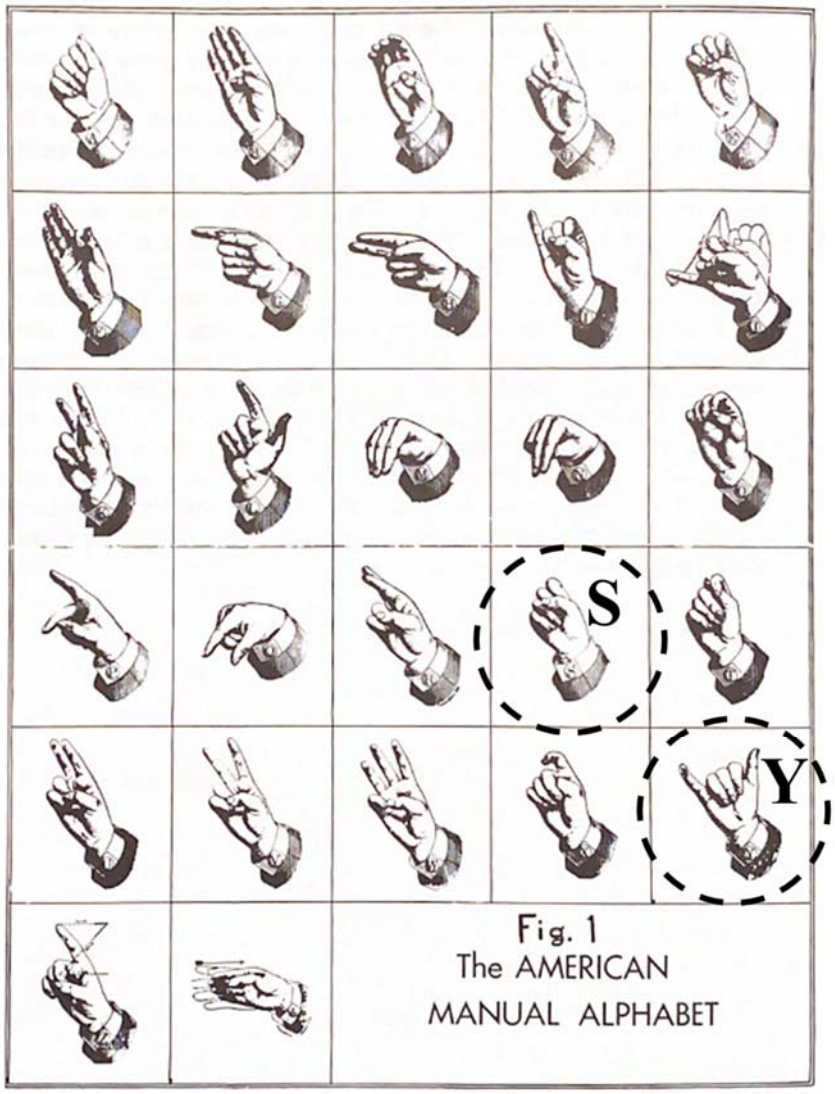
expectation of success in achieving such a modification because it would have involved applying known technologies (e.g., known gesture detection technology (*Liebermann* cellular phone)) and elements (e.g. known ASL signs (Stokoe, incorporated in *Liebermann*)) according to known methods (e.g., known gesture-based device control and gesture detection techniques (*Liebermann*)) to yield the predictable result of a cellular phone implemented to sense and detect American Sign Language in order to effect sign translation and resulting device control as part of an electronic sign language communication system. (*Id.*) *See KSR Intern. Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007).

7. Claim 6

a. A method according to claim 1, wherein movement of two fingers is sensed.

Liebermann discloses or suggests the limitations recited in claim 6. (Ex. PA-DEC, ¶¶ 122-123.) As described for claim 5, a POSITA would have understood that to sense (and determine) the full range of required finger movement, the sensed movements would have to include the information *Liebermann* discloses via the incorporated Stokoe publications. (Section V.A.6.)

In both *Semiotics and Human Sign Language* and *Sign Language Structure*, Stokoe includes a diagram showing the letters of the American Manual Alphabet which is used in conjunction with ASL. (Ex. PA-7, 22; Ex. PA-8, 28.) As pictured below, the American Manual Alphabet includes a variety of gestures with different finger arrangements. (Ex. PA-8, 28; *see also* Ex. PA-7, 22.) A POSITA would have understood from looking at this diagram, and from *Liebermann*'s disclosures that the device senses the full range of the alphabet, that the device senses "movement of two fingers." (Ex. PA-DEC, ¶ 123.) For example, a POSITA would have understood that moving from letter S to letter Y involves moving exactly two fingers (extending the thumb and the pinky). (Ex. PA-8, 28; Ex. PA-DEC, ¶ 123.)



(Ex. PA-8, 28 (FIG. 1 (annotated to show letters S and Y)).) Thus, a POSITA would have recognized that the *Liebermann* method includes sensing of "movement of two fingers." (Ex. PA-DEC, ¶ 123.) To the extent *Liebermann* does not disclose these gestures found in the incorporated publications, a POSITA would have found it obvious to modify the *Liebermann* method in view of *Liebermann*'s disclosures regarding these fundamental sign language texts for the same reasons as discussed for claim 5. (Section V.A.6.)

8. Claim 7

As explained below, *Liebermann* discloses or suggests the limitations recited in claim 7. (Ex. PA-DEC, ¶¶ 124-133.)

a. [7.a] Handheld computer apparatus comprising:

Liebermann discloses or suggests this preamble to the extent limiting. (Ex. PA-DEC, ¶¶ 124-125.) *Liebermann* discloses a "portable transmitter/receiver," as shown in FIG. 6, that is in the "form of a cellular telephone." (Ex. PA-1, 4:21-22, 5:62-63.) As explained in Section V.A.2.a, a POSITA would have understood that this cellular phone is handheld and contains a computer within the cellular phone frame, and is therefore a "handheld computer apparatus." (Section V.A.2.a; Ex. PA-DEC, ¶ 125.) *See also* MPEP § 2114 ("[T]he term 'computer' is commonly understood by one of ordinary skill in the art to describe a variety of devices with varying degrees of complexity and capabilities. *In re Paulsen*, 30 F.3d 1475, 1479-80, 31 USPQ2d 1671, 1674 (Fed. Cir. 1994). Therefore, a claim containing the term 'computer' should not be construed as limited to a computer having a specific set of characteristics and capabilities, unless the term is modified by other claim terms or clearly defined in the specification to be different from its common meaning."). The cellular phone also has a video camera, an LCD display, a key pad, and "an antenna 18 for the device so that it may be transported and communicate as a wireless remote or through a cellular telephone network." (Ex. PA-1, 5:62-6:2.) Through this wireless connection, the cellular phone performs local computer processing in conjunction with a remote "dedicated central computer facility" to "provide a novel electronic communication system for use by deaf persons to enable them to communicate by signing" with hearing persons. (*Id.*, 3:11-13, 5:62-6:14.) To the extent *Liebermann* is read to not disclose that the FIG. 6 cellular phone contains a computer and is therefore a "handheld computer apparatus," Section V.A.2.a also describes how a POSITA would have found it obvious to include a computer within the cellular phone so that the phone performs all processing within the *Liebermann* gesture recognition and device control method. (Section V.A.2.a.)

b. [7.b] a housing;

Liebermann discloses or suggests this limitation. (Ex. PA-DEC, ¶ 126.) *Liebermann* shows in FIG. 6 that the cellular phone device is within a single enclosing structure, which a POSITA would have understood is a "housing." (Ex. PA-1, FIG. 6; Ex. PA-DEC, ¶ 126.)

c. [7.c] a camera means associated with said housing for obtaining an image using

reflected light of at least one object positioned by a user operating said object;

Liebermann discloses or suggests this limitation. (Ex. PA-DEC, ¶ 127.) *Liebermann* discloses this limitation for similar reasons as explained for claim 1.d. (Section V.A.2.d.) The explanation for claim 1.d describes how the camera associated with the cellular phone uses reflected light (via electro-optical sensing) to obtain an image of "at least one finger" of the signing user. (*Id.*) A POSITA would have understood that the "at least one finger" of the signing user is also "at least one object positioned by a user operating said object" because of *Liebermann*'s repeated disclosures that the signing user signs by positioning fingers in various arrangements. (Ex. PA-DEC, ¶ 127.) Thus, *Liebermann* discloses a "camera means" as construed above (*see* Section IV.D)—that is, according to the agreed construction adopted by the district court, "a camera associated with said housing for obtaining an image using reflected light of at least one object positioned by a user operating said object." (Section IV.D.)

d. [7.d] computer means within said housing for analyzing said image to determine information concerning a position or movement of said object; and

Liebermann discloses or suggests this limitation. (Ex. PA-DEC, ¶¶ 128-130.) As explained for claim 7.a in Section V.A.8.a, a POSITA would have understood that this cellular phone is handheld and contains a computer within the cellular phone frame. (Sections V.A.8.a; Ex. PA-DEC, ¶ 128; *see also* Section V.A.2.a.) To the extent *Liebermann* is read to not disclose that the FIG. 6 cellular phone contains a computer, Section V.A.8.a also describes how a POSITA would have found it obvious to include a computer within the cellular phone so that the phone performs all processing within the *Liebermann* gesture recognition and device control method. (Sections V.A.8.a; Ex. PA-DEC, ¶ 128; *see also* Section V.A.2.a.) A POSITA would have understood that this internal computer is a "computer means within said housing" of the cellular phone. (Ex. PA-DEC, ¶ 128.)

For example, the computer in the cellular phone (as discussed above) would have been programmed to analyze "said image to determine information concerning a position or movement of said object" for similar reasons explained for claim 1. (*See generally*, Section V.A.2.) Section V.A.2 explains how the computer of *Liebermann*'s cellular phone would have performed

processing to analyze images and determine a corresponding set of identifiers for each captured finger gesture or movement, which a POSITA would have understood is "information concerning a position or movement of said object." (Section V.A.2; *see also* Section V.A.8.c (describing how the object can be a user's finger); Ex. PA-DEC, ¶ 129.) To the extent this claim is interpreted to require that the determined information relates to a complete gesture determination (rather than an intermediate fixed identifier determination), Section V.A.2.a explains how a POSITA would have found it obvious to implement the required processing (to determine the meaning of a finger position or movement) within the cellular phone's computer in view of *Liebermann*'s other disclosures. (*See generally*, Section V.A.2; *see also* Section V.A.2.a.) The same reasoning is applicable here. (Ex. PA-DEC, ¶ 129.) Thus, *Liebermann* discloses or suggests this limitation under PO's interpretation that "computer means" does not require construction or invoke 35 U.S.C. § 112, ¶ 6, which is consistent with the plain meaning found in the district court's construction order. (*See* Section IV.G.2.)

When construed under 35 U.S.C. § 112, ¶ 6 according to PO's initial alternative construction, *Liebermann* also discloses or suggests "a computer with at least one microprocessor specially programmed [] to determine information concerning a position or movement of said object." (*Id.*) As described in Section V.A.2.a, a POSITA would have understood that such a computer incorporated in *Liebermann*'s cellular phone would have had processor or similar component (e.g., microprocessor, etc.) in the computer. (Section V.A.2.a; Ex. PA-DEC, ¶ 130; Section V.A.2.a.; Ex. PA-11, 5:19-29 ("CPU 302 . . . may be an embedded processor or processor such as a Pentium processor from Intel Corporation").) Furthermore, a POSITA would have recognized and have been motivated to configure/program such a microprocessor to perform the above discussed identified function associated with limitation 7.d by running known gesture recognition software like that disclosed by *Liebermann*. (Ex. PA-1, 4:6-9 (disclosing "computer software for translating functions"), 6:6-10 ("The signing motions captured by the camera are converted into digital data for processing by the translation software . . . to produce data representing numbers, words and phrases which are then combined into coherent sentences."), 7:14-17, 7:45-49 ("Software presently used for [translation of the signing into and from digital text] is appended hereto and is utilized with Borland C++."); Ex. PA-DEC, ¶ 130.) When construed under 35 U.S.C. § 112, ¶ 6 according to PO's revised alternative construction, *Liebermann* also discloses or suggests "a computer" (*see* Section IV.G.2) that performs the same

identified function ("analyzing said image to determine information concerning a position or movement of said object") for similar reasons as described above for PO's initial alternative construction. (Ex. PA-DEC, ¶ 130.) *Liebermann* also discloses or suggests that the computer "analyz[es] to determine" (*see* Section IV.G.2) for similar reasons as described above because the incorporated computer in the cellular phone performs processing to *analyze* camera input *to determine* information concerning a position or movement of a finger. Thus, *Liebermann* discloses or suggests this limitation under both of PO's alternative constructions as well. (Section IV.G.2; Ex. PA-DEC, ¶ 130; *see also* SNQ6 in Section V.F.2.d, which describes how *Liebermann* in view of *Pinkney* discloses or suggests this limitation under Requester's alternative construction proposed under 35 U.S.C. § 112, ¶ 6.)

e. [7.e] means for controlling a function of said apparatus using said information.

Liebermann discloses or suggests this limitation. (Ex. PA-DEC, ¶¶ 131-133.) *Liebermann* discloses or suggests this limitation for similar reasons as explained for claims 1.c and 1.f. (Sections V.A.2.c, V.A.2.f.) Section V.A.2.c describes "moving at least one finger in space in order to signal a command to" the cellular phone apparatus. (Section V.A.2.c.) A POSITA would have understood that the "at least one finger" is also "at least one object positioned by a user operating said object." (Ex. PA-DEC, ¶ 131; *see also* Section V.A.9 (discussing claim 8, which explicitly states in the claim language that said object may be a finger).) Section V.A.2.a describes how it would be obvious to modify the cellular phone to have an internal computer perform all of the gesture recognition processing, and Section V.A.2.f describes how the cellular phone uses the sensed finger movement information to control various functions of the phone (controlling the signing content the cellular phone processes, transmits, and displays, as well as controlling the cellular phone through touchless function buttons) in accordance with an appropriate command. (Sections V.A.2.a, V.A.2.f.) A POSITA would have understood that this "sensed finger movement information" is also "information concerning a position or movement of said object." (Ex. PA-DEC, ¶ 131.) Thus, *Liebermann* discloses or suggests a "means for controlling a function of said apparatus using said information." (Sections V.A.2.a, V.A.2.c, V.A.2.f.)

As explained, when construed under 35 U.S.C. § 112, ¶ 6, *Liebermann* also discloses or suggests software running on a processor configured to perform the identified function or equivalents thereof. (Section IV.G.3.) As described above, the handheld computer apparatus

(cellular phone) "control[s] a function of said [handheld computer] apparatus using said information [concerning a position or movement of said object positioned by a user operating said object]." (Section IV.G.3.) As described in Section V.A.2.a, a POSITA would have understood that the computer incorporated in *Liebermann*'s cellular phone would have a processor or similar component in the computer, or would have been motivated to incorporate such a processor to facilitate the processing discussed in *Liebermann* as explained above. (Section V.A.2.a.) A POSITA would have likewise been motivated for similar reasons above to configure the processor to perform the identified function by running known gesture recognition software like that disclosed by *Liebermann*. (Ex. PA-1, 4:6-9 (disclosing "computer software for translating functions"), 6:6-10 ("The signing motions captured by the camera are converted into digital data for processing by the translation software . . . to produce data representing numbers, words and phrases which are then combined into coherent sentences."), 7:14-17, 7:45-49 ("Software presently used for [translation of the signing into and from digital text] is appended hereto and is utilized with Borland C++."); Ex. PA-DEC, ¶ 132.)

When construed under 35 U.S.C. § 112, ¶ 6 according to PO's interpretation, *Liebermann* also discloses or suggests "a computer with at least one microprocessor specially programmed for controlling said apparatus using said information" for similar reasons as described above. (Ex. PA-DEC, ¶ 133; Section IV.G.3.) A POSITA would have understood that the *Liebermann* processor as discussed above in the computer of the cellular phone would have included a microprocessor that would have been programmed in the way described above to perform the processes/function for the reasons discussed. (Ex. PA-DEC, ¶ 133; Section V.A.2.a.; Ex. PA-11, 5:19-29 ("CPU 302 . . . may be an embedded processor or processor such as a Pentium processor from Intel Corporation").) When construed under 35 U.S.C. § 112, ¶ 6 according to PO's revised interpretation, *Liebermann* also discloses or suggests "a control system associated with a camera." (Ex. PA-DEC, ¶ 133; Section IV.G.3.) In particular, a POSITA would have understood that the *Liebermann* apparatus is a "control system" because it allows for control of various cellular phone functions (as described above), and that the control system is "associated with a camera" because the cellular phone features a camera (as described for claim 7.c in Section V.A.8.c). When construed under 35 U.S.C. § 112, ¶ according to the district court's construction order, *Liebermann* further discloses or suggests "a control system programmed to control a function based on information concerning a position or movement of said object; and equivalents thereof."

(Section IV.G.3.) As described above, a POSITA would have understood that this *Liebermann* apparatus is a "control system," and that it could be programmed to control a function based on information concerning a position or movement of said object. (Ex. PA-DEC, ¶ 133.)

Accordingly, *Liebermann* discloses or suggests this limitation under the Requester's proposed constructions, the interpretations proposed by PO, those found by the district court, and the plain meaning for the claimed "means for controlling . . . ." (*See* Section IV.G.3.)

9. Claim 8

a. Apparatus according to claim 7, wherein said object is a finger.

Liebermann discloses or suggests the limitations recited in claim 8. (Ex. PA-DEC, ¶ 134.) *Liebermann* discloses these limitations for similar reasons to those explained for claim 7.c, which describes how the object can be the deaf user's finger. (Section V.A.8.c.)

10. Claim 9

a. Apparatus according to claim 7, further including a display function which is controlled.

Liebermann discloses or suggests the limitations recited in claim 9. (Ex. PA-DEC, ¶ 135.) *Liebermann* discloses these limitations for similar reasons as described for claim 7.e, which refers to the explanation for claim 1 to describe how a deaf user signs in view of the cellular phone apparatus and thereby controls which translated text (corresponding to the communicated signs) is shown on the display corresponding to the communicated signs, and how a deaf user controls the touchless function buttons on the display depending on the signed command. (Section V.A.8.e; *see generally* Section V.A.2.) A POSITA would have understood that these control functions are "display function[s] which [are] controlled." (Ex. PA-DEC, ¶ 135.) Thus, under PO's interpretation that no construction is required for this term, which is consistent with the plain meaning found by the district court's construction order, *Liebermann* discloses or suggests these limitations recited in claim 9. (Section IV.G.4; Ex. PA-DEC, ¶ 135; *see also* SNQ3 in Section V.C.2., which describes how *Liebermann* in view of *Maruno* discloses or suggests this limitation under Requester's construction under 35 U.S.C. § 112, ¶ 6.)

11. Claim 11

a. Apparatus according to claim 7, further including means for transmitting information.

Liebermann discloses or suggests the limitations recited in claim 11. (Ex. PA-DEC, ¶¶ 136-137.) *Liebermann* describes the FIG. 6 cellular phone as a "portable transmitter/receiver" that has "an antenna 18 for the device so that it may . . . communicate as a wireless remote or through a cellular telephone network." (Ex. PA-1, 5:62-6:2.) Thus, when construed under 35 U.S.C. § 112, ¶ 6 according to the district court's construction order, *Liebermann* discloses "a cell phone, and equivalents thereof." (Section IV.G.5.) When construed under 35 U.S.C. § 112, ¶ 6 according to Requester's interpretation, *Liebermann* discloses a "cellular transceiver" and its equivalents because a POSITA would have understood that *Liebermann*'s cellular phone provides transmitter/receiver functionalities through known components, such as an "antenna 18 . . . so [the device] may be transported and communicate as a wireless remote or through a cellular telephone network" (Section IV.G.5; Ex. PA-1, 5:67-6:2). A POSITA would have understood that *Liebermann*'s cellular phone would necessarily have included receiver/transmitter components that collectively operate as a "transceiver" in order to facilitate such communications. (Ex. PA-DEC, ¶ 136.) Without such a "transceiver," *Liebermann*'s cellular phone would not operate to send and receive as disclosed. (*Id.*) (*See also* Section IV.G.5, Ex. PA-DEC, ¶ 136.) Likewise, when construed under 35 U.S.C. § 112, ¶ 6 according to PO's interpretation, *Liebermann* discloses a "transmitter" for the same reasons and because *Liebermann* discloses that the FIG. 6 cellular phone is a "portable *transmitter*." (Section IV.G.5; Ex. PA-DEC, ¶ 136.)

Liebermann discloses that "a captured image undergoes a process whereby the image is collapsed into a small set of fixed identifiers," and "[a]t the end of the initial processing, the resulting information is sent as data on a regular and designated phone line using an internal modem in the device to [computers at] the data processing center." (Ex. PA-1, 6:42-52.) The center then completes additional processing to convert identifiers to text and then to speech, "and the speech is sent as an analog content to the normally hearing person." (*Id.*, 6:53-63.) This means for transmitting information to the center and ultimately the hearing person's device is made possible because "the cellular phone maintains two cellular connections on line, one to the center (voice/data) and one to the [hearing] caller." (*Id.*, 7:24-26.) As discussed in Sections V.A.2.a and

V.A.8.a and applicable here, a POSITA would have found it obvious to modify this processing system so that the cellular phone's computer performs all gesture recognition processing and sends the translated speech directly to the hearing user's device. (Section V.A.2.e; Ex. PA-DEC, ¶ 137.) Nevertheless, a POSITA would have understood that the cellular phone still transmits data and other information to the hearing user's device. (Ex. PA-DEC, ¶ 137.)

Accordingly, *Liebermann* discloses or suggests this limitation under the Requester's proposed constructions, the interpretations proposed by PO, and those found by the district court for the claimed "means for transmitting information." (*See* Section IV.G.5.)

12. Claim 12

a. Apparatus according to claim 7, further including a light source for illuminating said object.

Liebermann discloses or suggests the limitations recited in claim 12. (Ex. PA-DEC, ¶¶ 138-141.) While *Liebermann* does not expressly disclose that the FIG. 6 cellular phone provides a light source adapted to direct illumination through a work volume above the light source, a POSITA would have found it obvious to implement such a feature in view of *Liebermann*'s other disclosures. (*Id.*, ¶ 138.)

A POSITA would have understood from *Liebermann*'s disclosures that adequate lighting of the deaf user's gestures is critical. (Ex. PA-DEC, ¶ 139.) In a public telephone kiosk version (FIG. 5C) of the *Liebermann* invention—which operates in substantially the same way as the cellular phone—the kiosk features "lamps 48 to ensure adequate lighting of the user's hands, face and body." (Ex. PA-1, 5:57-59, FIG. 5C (reproduced below).) A POSITA would have understood that in this kiosk, the lights are for illuminating "said object"—as well as designed to transmit light directly onto (*see* Section IV.E) the user's hands and fingers used to form signs. (Ex. PA-DEC, ¶ 139; *see also* Section V.A.8.c (describing how the "at least one finger" of the signing user is also "at least one object positioned by a user operating said object" because of *Liebermann*'s repeated disclosures that the signing user signs by positioning fingers in various arrangements).)

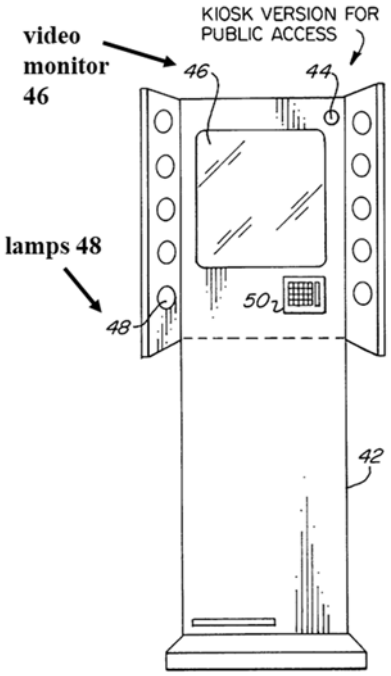


FIG. 5C

(Ex. PA-1, FIG. 5C (annotated to show lamps 48 on sides of display 46).)

A POSITA would have been motivated to install similar lights in the FIG. 6 cellular phone alongside the display (e.g., lights to provide adequate lighting that accommodate the cellular phone implementation). (Ex. PA-DEC, ¶ 140.) A POSITA would have recognized that the cellular phone detects gestures in much the same way as the kiosk and has similar lighting needs in order to adequately illuminate the gestures. (*Id.*) Furthermore, a POSITA would have understood that a cellular phone would desirably be functional in low ambient light settings, and that the cellular phone in FIG. 6 does not disclose a light source in the cellular phone that would allow for full functionality in low ambient light situations. (*Id.*) Thus, a POSITA would have understood the benefits of modifying the *Liebermann* cellular phone in order to incorporate a light source (lights alongside the display) for illuminating the user's hands used to form gestures. (*Id.*)

A POSITA would have also had a reasonable expectation of success in implementing this modification because, as noted above, the modification would have merely involved implementing lights similar to those in the *Liebermann* public telephone kiosk in the *Liebermann* cellular phone, which a POSITA would have understood uses similar hardware and processor components to implement the same gesture detection and communication method. (*Id.*, ¶ 141.) Integrating a light into a cellular phone was well known at the time of the invention. (*Id.*; Ex. PA-13, Abstract

(disclosing a "portable telephone with flashlight"), 1:10-65 (describing how "[n]umerous innovations for illuminated telephones have been provided in the prior art," where each described illuminated telephone incorporates a light into the portable phone).) Moreover, a POSITA would have had the skill to implement, and expectation of success in achieving such a modification because it would have involved applying known technologies (e.g., known gesture detection technology (*Liebermann* cellular phone)) and materials (e.g., known light sources (state of the art)) according to known methods (e.g., known light-aided gesture detection techniques and known arrangements of implementing lights in a preferred detection device (*Liebermann* kiosk)) to yield the predictable result of a cellular phone implemented with a separate light source that directly illuminates through a work volume above the light source. (Ex. PA-DEC, ¶ 141.) *See KSR Intern. Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007).

Accordingly, *Liebermann* discloses or suggests this limitation under both the Requester's proposed construction, and the plain meaning proposed by PO and found by the district court for the claimed "light source for illuminating said object." (*See* Section IV.E.)

13. Claim 13

a. Apparatus according to claim 7, wherein said apparatus is a cellular phone.

Liebermann discloses or suggests the limitations recited in claim 13. (Ex. PA-DEC, ¶ 142.) *Liebermann* discloses or suggests these limitations for the same reasons as explained for claim 7.a, which explains how the handheld computer apparatus is a cellular phone. (Section V.A.8.a; Ex. PA-DEC, ¶ 142.)

14. Claim 14

Liebermann discloses or suggests the limitations recited in claim 14. (Ex. PA-DEC, ¶¶ 143-147.) For clarity, the limitations of claim 14 are discussed in parts below.

a. [14.a] A method for controlling a handheld computing device comprising the steps of:

Liebermann discloses or suggests this preamble to the extent limiting. (Ex. PA-DEC, ¶ 143.) *Liebermann* discloses or suggests this limitation for the same reasons as those explained for claim 1.a. (Section V.A.2.a.)

b. [14.b] providing a computer within said device;

Liebermann discloses or suggests this limitation. (Ex. PA-DEC, ¶ 144.) As discussed in Section V.A.2.a, a POSITA would have understood that the *Liebermann* cellular phone contains a computer within the cellular phone frame. (Section V.A.2.a.) Section V.A.2.a also explains how to the extent *Liebermann* does not disclose an internal computer, a POSITA would have found it obvious to modify the cellular phone to have an internal computer that performs all of the gesture recognition processing in the *Liebermann* method. (*Id.*) Thus, *Liebermann* discloses or suggests "a computer within said device." (Ex. PA-DEC, ¶ 144.)

c. [14.c] associating a camera with said device, said camera viewing at least a portion of the body of a user operating said device or an object held by said user, in order provide image data concerning said portion or object;

Liebermann discloses or suggests this limitation. (Ex. PA-DEC, ¶ 145.) *Liebermann* discloses that the cellular phone device "contains a video camera, the lens 10 of which is disposed in the upright portion 12." (Ex. PA-1, 5:62-65.) The deaf user operating the device is "positioned so that the camera lens 10 will record the signing movement of the hands and fingers and body and facial motions and expressions." (*Id.*, 6:2-6.) The camera provides image data concerning these portions of the user's body by capturing images "of the finger and hand motions and of body motions and of facial expressions" and provides this image data as input for the "initial processing" performed within the cellular phone device. (*Id.*, 6:42-47.) Thus, the associated camera views "at least a portion of the body of a user operating said device . . . in order [to] provide image data concerning said portion or object." Thus, *Liebermann* discloses or suggests the method step of "associating a camera with the device . . ." as claimed in limitation 14.c.

d. [14.d] using said computer, analyzing said image data to determine information concerning a user input command; and

Liebermann discloses or suggests this limitation. (Ex. PA-DEC, ¶ 146.) *Liebermann* discloses that this computer "analyz[es] said image data to determine information concerning a user input command" for similar reasons as explained for claim 1.e. (Section V.A.2.e.) Section V.A.2.e explains how the computer of the cellular phone performs processing to analyze images and determine a corresponding set of identifiers for each captured finger gesture or movement, which a POSITA would have understood is a "user input command" to control the device. (Section V.A.2.e; *see also* Sections V.A.2.a and V.A.2.c (describing how these finger and hand movements are user input commands to control the device); Ex. PA-DEC, ¶ 146.) In this way, *Liebermann* discloses or suggests the method step of "using [the] computer . . ." as claimed in limitation 14.d. To the extent this claim is interpreted to require that the determined information relates a complete gesture determination (rather than intermediate fixed identifier determination), Sections V.A.2.a and V.A.2.e explain how a POSITA would have found it obvious to implement the required processing (to determine the meaning of a finger movement) within the cellular phone's computer in view of *Liebermann*'s other disclosures. (Sections V.A.2.a, V.A.2.e.) The same reasoning is applicable here. (Ex. PA-DEC, ¶ 146.)

e. [14.e] from said determined information, controlling a function of said device.

Liebermann discloses or suggests this limitation. (Ex. PA-DEC, ¶ 147.) *Liebermann* discloses or suggests this limitation for similar reasons as explained for claims 1.c and 1.f. (Sections V.A.2.c, V.A.2.f.) Section V.A.2.c describes "moving at least one finger in space in order to signal a command to" the cellular phone. (Section V.A.2.c.) A POSITA would have understood that the "at least one finger" is also "at least a portion of the body of the user." (Ex. PA-DEC, ¶ 147.) Section V.A.2.f describes how the sensed finger movement information is used to control various functions of the cellular phone (controlling the signing content the device processes, transmits, and displays, as well as controlling the device through touchless function buttons) in accordance with an appropriate command. (Section V.A.2.f.) A POSITA would have understood that this "sensed finger movement information" is also "determined information concerning a user input command" because the signs serve as user input commands. (Ex. PA-

DEC, ¶ 147.) Thus, for the reasons explained for claims 1.c and 1.f, *Liebermann* discloses or suggests "from said determined information, controlling a function of said device."

15. Claim 15

a. A method according to claim 14, wherein reflected light from said body portion or object is imaged by said camera.

Liebermann discloses or suggests the limitations recited in claim 15. (Ex. PA-DEC, ¶ 148.) *Liebermann* discloses or suggests these limitations for similar reasons to those explained for claim 14.c, which explains how the camera captures images of the deaf user's body portion, and for claim 7.c, which refers to claim 1.d to explain how a camera operates by imaging reflected light from the captured object. (Sections V.A.2.d, V.A.8.c, V.A.14.c; Ex. PA-DEC, ¶ 148.)

16. Claim 16

a. A method according to claim 14, wherein said information includes the position of the portion or object.

Liebermann discloses or suggests the limitations recited in claim 16. (Ex. PA-DEC, ¶ 149.) As explained for claim 14.d, "said information" may include any of the information concerning a user input command (i.e., a sign or signs) that the computer determines from image data—including information relating to translation of the signs to text. (Section V.A.14.d.) *Liebermann* discloses that this information used to effect translation into English translation "includes the position of the portion or object" (i.e., the hands, fingers, body, or facial expressions). In particular, *Liebermann* discloses that the electronic communication method must determine the location or position of portions of a user. Because "ASL is a visual-spatial language requiring simultaneous, multiple, dynamic articulations," "[a]t any particular instant, one has to combine information about the handshape (Stokoe's 'dez'), the motion (Stokoe's 'sig') and the *spatial location of the hands* relative to the rest of the body (Stokoe's 'tab')." (Ex. PA-1, 10:59-64 (internal quotations added).) As shown in FIG. 9 (reproduced below), which displays "a schematic representation of the modules of the artificial intelligence for converting signing into speech," the disclosed method requires "*calculating centers of gravity for both hands*," which involves finding an "*FFT [fast Fourier transform] of paths of the hands*" as well as performing an "*explicit path analysis*" of the

hands. (*Id.*, 4:31-32, FIG. 9.) FIG. 9 discloses in other portions of the conversion process that a "*2 hand FFT and their location*" are determined by the static gesture manager, and a "*right hand FFT*" is determined by the spelling mode manager. (*Id.*, FIG. 9.) A POSITA would have understood that calculating the center of gravity of a hand, performing a fast Fourier transform, and conducting path analysis all require determining the position of a point on the user's hand, which is a "portion or object" as claimed. (Ex. PA-DEC, ¶ 149.) Furthermore, *Liebermann* discloses or suggests in numerous places that position coordinates of the hands and other body parts are determined. (Ex. PA-1, 13:22-23 (suggesting that "coordinates" of signs are determined), 7:44-9:27 (disclosing an algorithm for feature tracking, which detects the location of various parts of the head, torso, arms, and legs).)

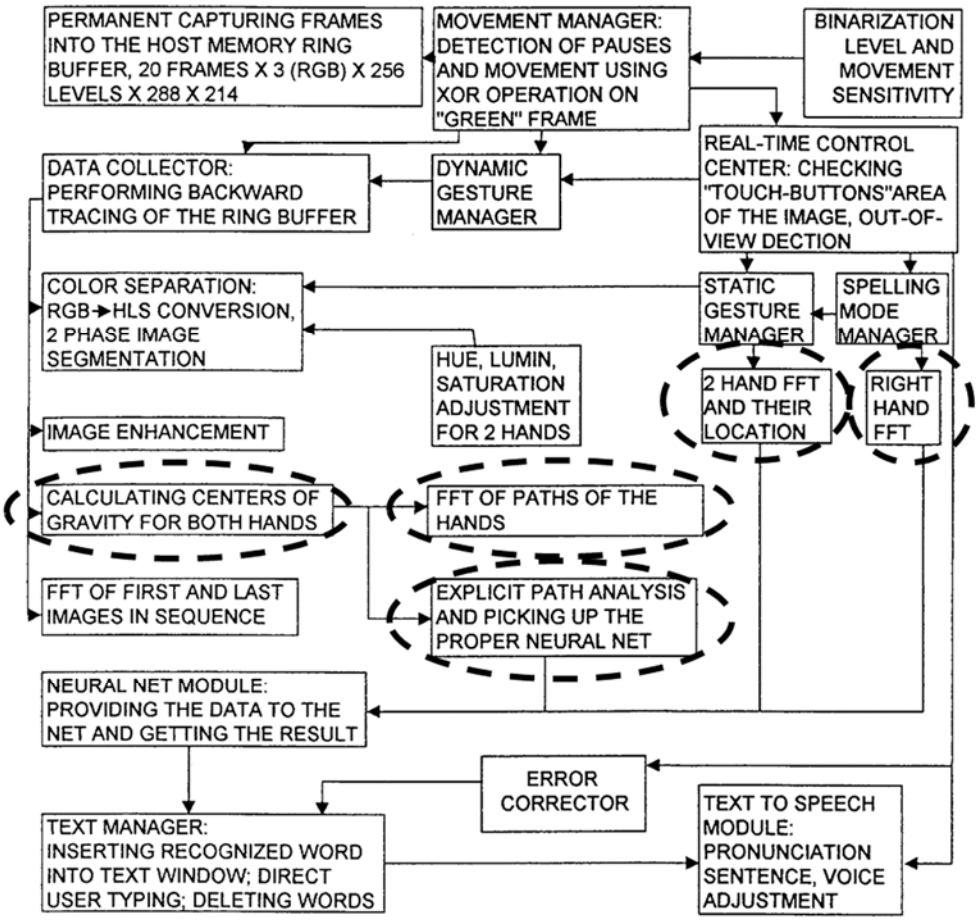


FIG. 9

(*Id.*, FIG. 9 (annotated to show the portions of the sign to speech conversion, each of which involve determining positions of portions of the user's body, as discussed above).)

17. Claim 17

a. A method according to claim 14, wherein said information includes the change in position of the portion or object.

Liebermann discloses or suggests the limitations recited in claim 17. (Ex. PA-DEC, ¶ 150.) *Liebermann* discloses or suggests these limitations for similar reasons as explained for claim 16. (Section V.A.16.) Section V.A.16 describes how the Liebermann method requires "calculating centers of gravity for both hands," which involves finding an "FFT [fast Fourier transform] of paths of the hands" as well as performing an "explicit path analysis" of the hands. (Id., 4:31-32, FIG. 9.) A POSITA would have understood that an "explicit path analysis" requires determining the change in position of a point on the user's hand, which is a "portion or object" as claimed. (Ex. PA-DEC, ¶ 150.)

18. Claim 18

a. A method according to claim 14, wherein said information includes the velocity or path of the portion or object.

Liebermann discloses or suggests the limitations recited in claim 18. (Ex. PA-DEC, ¶ 151.) *Liebermann* discloses these limitations for similar reasons as explained for claim 16. (Section V.A.16.) Section V.A.16 describes how the Liebermann method determining an "explicit path analysis" of the hands. (Id., 4:31-32, FIG. 9.) Thus, *Liebermann* discloses that the determined information "includes the . . . path of the" user's hand, which is a "portion or object" as claimed. (Ex. PA-DEC, ¶ 151.)

19. Claim 19

a. A method according to claim 14, wherein said information is obtained in 3 dimensions.

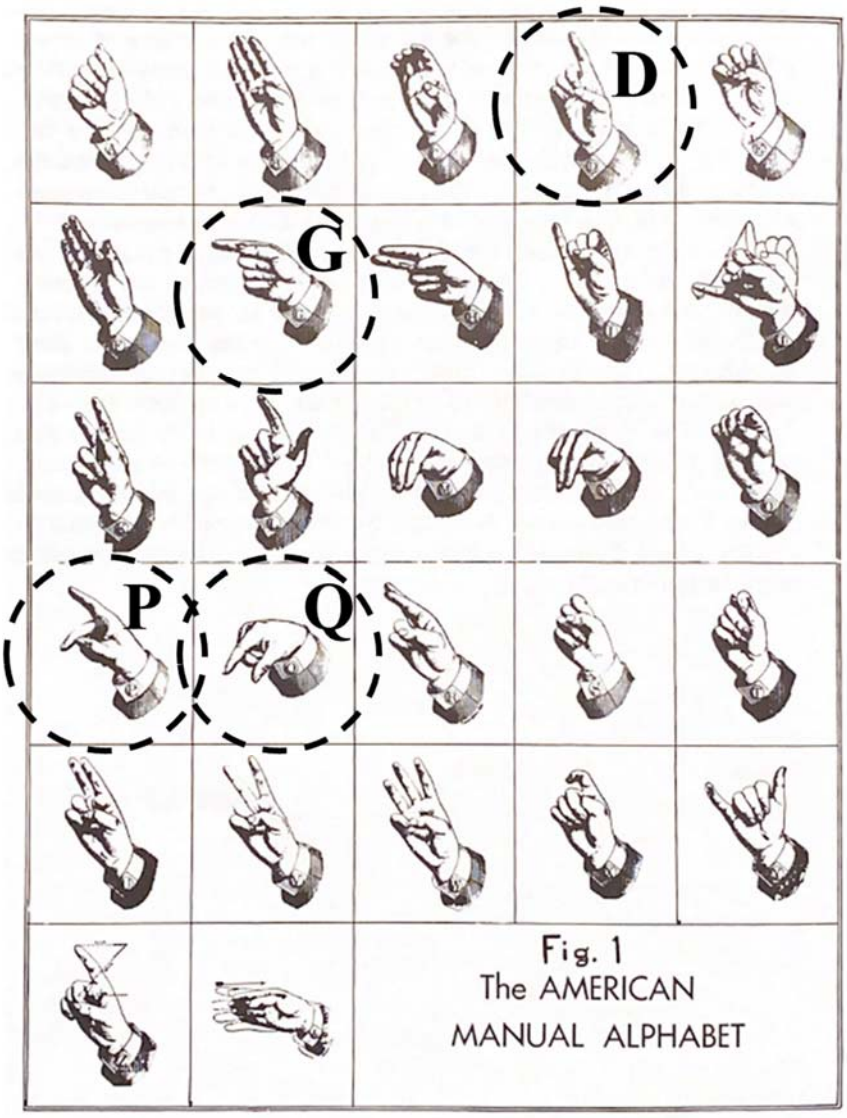
Liebermann discloses or suggests the limitations recited in claim 19. (Ex. PA-DEC, ¶ 152.) *Liebermann* discloses or suggests these limitations for similar reasons as explained for claim 4. (Section V.A.5.) While claim 4 recites that "movement [of at least one finger] is sensed in 3 dimensions," and claim 19 recites that "information [concerning a user input command] is obtained

in 3 dimensions," the same reasoning as explained for claim 4 is still applicable for claim 19. (Sections V.A.5, V.A.14.d; Section IV.F; Ex. PA-DEC, ¶ 152.) This is because, as discussed for claim 14.d, "said information" includes movement of the signing user's fingers. (Section V.A.14.d.) Accordingly, *Liebermann* discloses or suggests this limitation under both the Requester's proposed construction, and the plain meaning proposed by PO and found by the district court for the claimed "wherein said information is obtained in 3 dimensions" term. (*See* Section IV.F.)

20. Claim 20

a. A method according to claim 14, wherein said information includes the pointing direction of the portion or object.

Liebermann discloses or suggests the limitations recited in claim 20. (Ex. PA-DEC, ¶ 153.) As discussed for claim 6, a POSITA would have understood the need to consult the diagram of the American Manual Alphabet in *Semiotics and Human Sign Language* and *Sign Language Structure* in order to implement the *Liebermann* method. (Section V.A.7; Ex. PA-7, 22; Ex. PA-8, 28.) As pictured below, the American Manual Alphabet includes a variety of gestures with fingers pointing in various directions. (Ex. PA-8, 28; *see also* Ex. PA-7, 22.) For example, letter D involves pointing upwards; letter G involves pointing left (if signing with a right hand); letter P involves pointing upwards at an angle; and letter Q involves pointing downwards at an angle. (Ex. PA-8, 28; Ex. PA-DEC, ¶ 153.)



(Ex. PA-8, 28 (FIG. 1 (annotated to show pointing gestures in different directions used for finger spelling)).) A POSITA would have recognized that in order to clearly distinguish between the finger spelling of these letters, and accurately determine the user input command used to control a device function (*see* Sections V.A.14.d-e), the disclosed method of *Liebermann* would need to be able to determine which direction the finger points in the work volume. (Ex. PA-DEC, ¶ 153.) To the extent *Liebermann* does not disclose these gestures found in the incorporated publications, a POSITA would have found it obvious to modify the *Liebermann* method in view of *Liebermann*'s disclosures regarding these fundamental sign language texts for the same reasons as discussed for claim 5. (Section V.A.6.)

21. Claim 21

a. A method according to claim 14, wherein a display is controlled.

Liebermann discloses or suggests the limitations recited in claim 21. (Ex. PA-DEC, ¶ 154.) *Liebermann* discloses or suggests these limitations for similar reasons as described for claim 14.e, which refers to the explanation for claim 1 to describe how a deaf user signs in view of the cellular phone apparatus and thereby controls which translated text (corresponding to the communicated signs) is shown on the display corresponding to the communicated signs, and how a deaf user controls the touchless function buttons on the display depending on the signed command. (Section V.A.14.e; *see generally* Section V.A.2.) A POSITA would have understood that these control functions involve "a display [which] is controlled." (Ex. PA-DEC, ¶ 154.)

22. Claim 25

a. A method according to claim 14, including the further step of transmitting data to a further device.

Liebermann discloses or suggests the limitations recited in claim 25. (Ex. PA-DEC, ¶ 155.) *Liebermann* discloses or suggests these limitations for similar reasons as those explained for claim 11. (Section V.A.11.) While claim 11 recites an apparatus "further including means for transmitting information" and claim 25 recites a method "including the further step of transmitting data to a further device," the discussion regarding claim 11 is applicable to claim 25 because it explains how the cellular phone apparatus (which is part of the claim 14 method) transmits data to a further device (a hearing user's device, and potentially also an intermediate computer device at the central processing facility). (Sections V.A.11; Ex. PA-DEC, ¶ 155.)

23. Claim 26

a. A method according to claim 14, wherein said camera operates at 30 frames per second or greater.

Liebermann discloses or suggests the limitations recited in claim 26. (Ex. PA-DEC, ¶ 156.) *Liebermann* discloses that when "the deaf person uses sign language in front of [the] device," the "images [are] captured by the camera at 20-30 frames/second." (Ex. PA-1, 4:60-64.) *Liebermann* further discloses "considering a real time operation of 30-frames/sec" in order to "effectuat[e] real

time transmission of the data as to images," and notes that "transmit[ting] fewer frames per second" would be "an unacceptable method as it results in jerky motions and becomes difficult to interpret visual signing gestures." (*Id.*, 12:7-29.) Thus, *Liebermann* discloses or suggests that the "camera operates at 30 frames per second or greater."

24. Claim 28

a. A method according to claim 14, including the further step of acquiring a picture of the user of the handheld device.

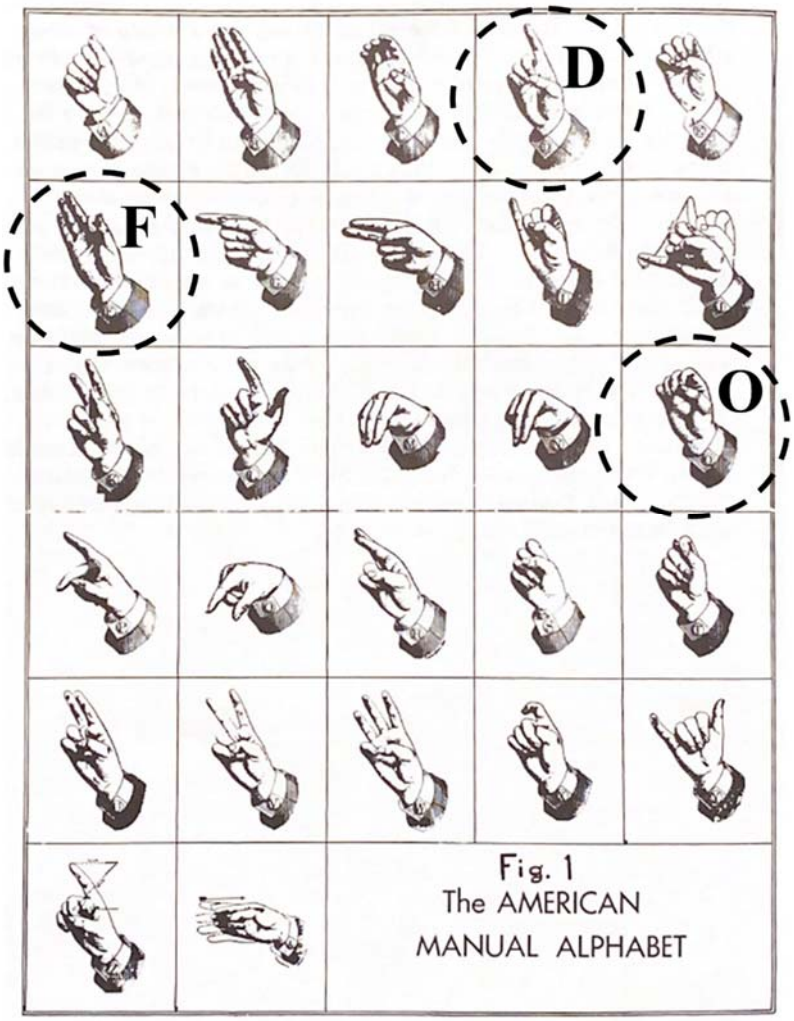
Liebermann discloses or suggests the limitations recited in claim 28. (Ex. PA-DEC, ¶ 157.) *Liebermann* discloses that the cellular phone has a video camera that "record[s] the signing movement of the hands and fingers and body and facial motions and expressions" of the signing user. (Ex. PA-1, 6:2-6.) "The images captured by the camera at 20-30 frames/second," where "each of the frames containing a captured image undergoes a process whereby the image is collapsed into a small set of fixed identifiers." (*Id.*, 4:60-64, 6:42-52.) *Liebermann* discloses that "[t]he images captured by the camera are of the finger and hand motions and of body motions and of facial expressions." (*Id.*, 6:42-47.) A POSITA would have understood that these frame images of the signing user are "picture[s] of the user of the handheld device." (Ex. PA-DEC, ¶ 157.)

25. Claim 29

a. A method according to claim 14, wherein two fingers of the user are sensed and a pinching action determined.

Liebermann discloses or suggests the limitations recited in claim 29. (Ex. PA-DEC, ¶ 158.) As discussed for claim 6, a POSITA would have understood the need to consult the diagram of the American Manual Alphabet in *Semiotics and Human Sign Language* and *Sign Language Structure* in order to implement the *Liebermann* method. (Section V.A.7; Ex. PA-7, 22; Ex. PA-8, 28.) Likewise, the discussion for claim 5 explains how the *Liebermann* method senses the movement of fingers as they transition between alphabet signs. (Section V.A.6.) A POSITA would have also understood from looking at this diagram, pictured below, that transitioning to letters D, F, and O each involves a pinching action—signing D involves a pinch of the thumb and middle finger; signing F involves a pinch of the thumb and index finger; and signing O involves a pinch of the

thumb and index finger (like F, but with remaining fingers relaxed). (Ex. PA-8, 28; Ex. PA-DEC, ¶ 158.)



(Ex. PA-8, 28 (FIG. 1 (annotated to show the pinching gestures of the American Manual Alphabet).) A POSITA would have understood that in order to detect the pinching gesture of these letters, the *Liebermann* method would also have to be able to sense and determine the *action* of the two fingers moving into a pinch in order to accurately translate signs to English because, for example, the system would need to be able to identify whether the movement represents the motion portion of a sign or merely a transition to the next sign to be translated. (Ex. PA-DEC, ¶ 158; *see also* Ex. PA-1, 10:59-67 (disclosing that ASL signs incorporate information about the hand motion (Stokoe's sig)).) Thus, *Liebermann* discloses or suggests sensing "two fingers of the user" and determining a "pinching action."

26. Claim 30

a. A method according to claim 14, wherein said body portion indicates an expression of said user.

Liebermann discloses or suggests the limitations recited in claim 30. (Ex. PA-DEC, ¶ 159.) *Liebermann* discloses or suggests these limitations for the same reasons as explained for claim 14.c, which describes how the camera views the facial expressions of the signing user. (Section V.A.14.c; Ex. PA-DEC, ¶ 159.) A POSITA would have understood that image data of this facial expression can be used to "determine information concerning a user input command" and "from said determined information, control[] a function of said device" because *Liebermann* discloses that facial expressions add meaning to the determined hand or finger. (Ex. PA-DEC, ¶ 159.) In particular, *Liebermann* notes that facial expressions can provide "grammatical delineation"—"[f]or example, the eyebrows when raised indicate surprise but when drawn down in a frown like manner signify negation or suspicion." (Ex. PA-1, 11:3-8.) Facial expressions can even change the entire meaning of a signed word—for example, "[a] protruding tongue synchronized with the sign 'late' turns the meaning into 'not yet.'" (*Id.*, 11:8-11.) Thus, the *Liebermann* method "wherein said body portion indicates an expression of said user" also discloses or suggest the limitations of claim 14. (Ex. PA-DEC, ¶ 159; *see generally* Section V.A.14.)

27. Claim 31

a. A method according to claim 14, wherein said information provides an aid to speech recognition.

Liebermann discloses or suggests the limitations recited in claim 31. (Ex. PA-DEC, ¶¶ 160-161.) *Liebermann* discloses that "said information" concerning a user input command "provides an aid to speech recognition" in two ways. (*Id.*, ¶ 160.) As described for claim 14.d, the *Liebermann* method analyzes image data to determine various information, including manageable identifiers. (Section V.A.14.d.) The identifiers are "then correlated with a database of vocabulary and grammar by using artificial intelligence," and are ultimately converted to equivalent text and then audible speech for the hearing person. (Ex. PA-1, 4:64-5:13.) Thus, a POSITA would have understood that "said information" provides an aid to the gestural speech recognition process that converts ASL to English. (Ex. PA-DEC, ¶ 160.)

Liebermann also discloses using the signing information to provide an aid to audible speech recognition. *Liebermann* discloses that the electronic communication method includes a speech recognition process whereby a hearing user's speech is converted into ASL and conveyed to the signing user. (Ex. PA-1, 5:16-21 ("speech recognition algorithms convert the spoken word to text").) "The recognized speech is then transformed into its equivalent signing content vocabulary and then into text" and is ultimately "converted to signing animation" shown on the signing user's display. (*Id.*, 5:21-34.) *Liebermann* further discloses that the processing to translate between signs and text "utilizes artificial intelligence such as neural networks trained for the specific applications of the device," as well as "system training methods" in order to effect such artificial intelligence processing. (*Id.*, 6:53-63, 6:37-39 ("FIGS. 9-12 are schematics of the system software modules for converting signing to speech and speech to animation, including system training methods.").) A POSITA would have understood that in artificial intelligence systems such as the system in *Liebermann*, system training methods would use the detected signing information (and the equivalent text) to train and improve the process by which text is converted back to signing animation. (Ex. PA-DEC, ¶ 161.) Since the text-to-sign conversion is part of the greater audible speech recognition process by which the hearing user's speech is conveyed to the signing user as animated signs, a POSITA would have understood that "said information" also provides an aid to audible speech recognition. (*Id.*)

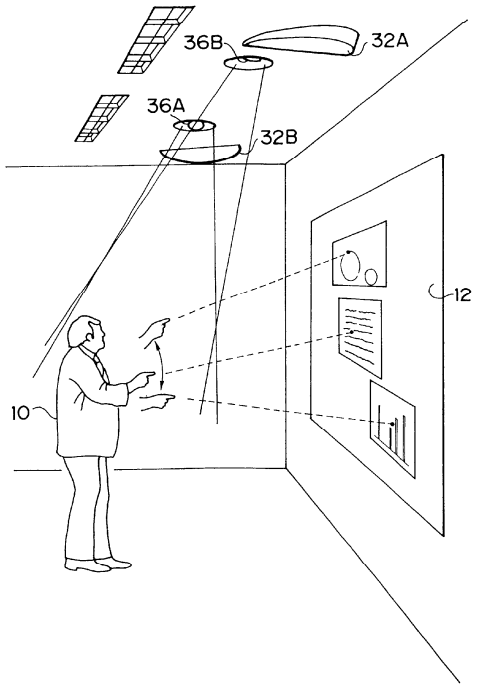
B. SNQ2: *Liebermann* in view of *Harakawa*

As explained below and in the attached declaration of Dr. Abowd (Ex. PA-DEC), *Liebermann* in view of *Harakawa* discloses or suggests the limitations of claim 20 of the '431 patent. (Ex. PA-DEC, ¶¶ 63-70, 162-169.)

1. Overview of *Harakawa*

Harakawa discloses "a large-screen display 12 [that] is built into a wall surface in a place at which an information inputting person 10 . . . arrives. (Ex. PA-2, 15:11-14.) The display, which may be "a liquid crystal display (LCD), a plasma display, a cathode ray tube (CRT) [or] an optical fiber display," connects to an information processor "composed of a personal computer or the like." (*Id.*, 15:14-19.) "[T]he information inputting person 10 arrives at the place (information input space) shown in FIG. 1 in front of the display 12," and then "points to a position on the display surface of the display 12." (*Id.*, 15:23-27.) By making "a click motion," the information inputting person may "give[] various instructions to the information processor" which "allows various types of processing to be executed." (*Id.*, 15:28-31.) *Harakawa* further discloses that the invention includes a "plurality of near-infrared light illuminators 32A and 32B" and a "plurality of video cameras 36A and 36B," each of which is oriented to illuminate or capture the information inputting person in the information input space. (*Id.*, 15:42-16:30.) Many of these elements are illustrated in FIG. 1 of *Harakawa*, which is reproduced below.

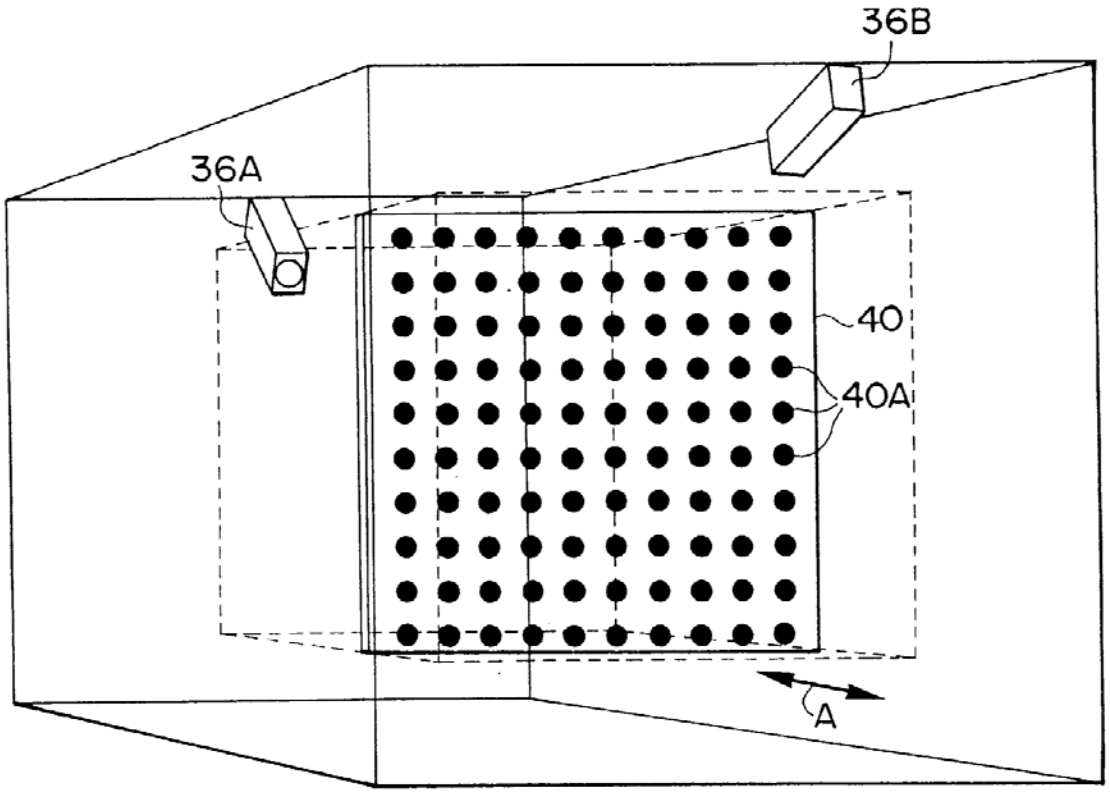
F I G. 1



(*Id.*, FIG. 1.)

In a series of lattice point initialization steps, the three-dimensional coordinates (x, y, z) in the information input space are mapped to the two-dimensional positions of the images A and B, which are the areas captured by cameras 36A and 36B, respectively. (*Id.*, 16:52-17:59.) This initialization is accomplished by moving a transparent mark plate 40 with an equally spaced matrix of marks 40A through the information input space, and at each step (i) calculating the three-dimensional coordinates of marks 40A at the mark plate 40's current position, and (ii) extracting the two-dimensional positions of the marks 40A in each of image A and B. (*Id.*) As the mark plate is moved to cover the information input space, the result is that "the multiplicity of marks 40A recorded on the mark plate 40 are moved to the positions corresponding to the multiplicity of lattice points (corresponding to virtual points) which are uniformly [sic] spaced in a lattice arrangement in the information input space." (*Id.*, 17:33-38.) This "correspondence between the three-dimensional coordinates of the lattice points in the information space and the positions thereof" on images A and B is stored in memory as the lattice point position information of each video camera. (*Id.*, 17:38-47.) FIG. 4 of *Harakawa* illustrates the movement of the mark plate within the information input space, and is reproduced below.

F I G. 4

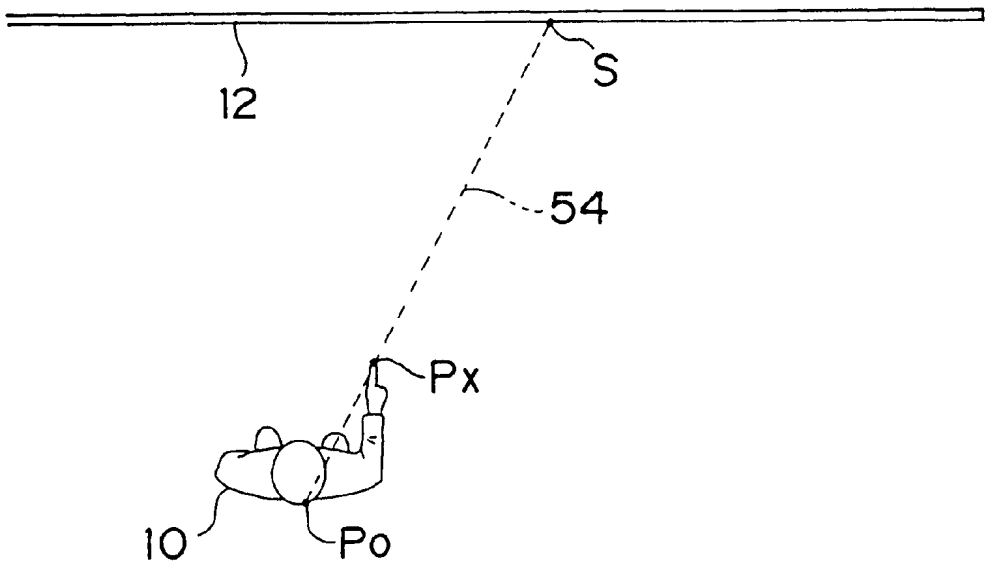


(*Id.*, FIG. 4.)

Harakawa discloses that after initialization processes are complete, "a full-length image of the information inputting person 10 [is] extracted from the images A and B." (*Id.*, 19:47-49.) Then, "the three-dimensional coordinates, (x_0, y_0, z_0) of a reference point P_0 of the information inputting person 10" are determined using the captured images, where " the point . . . corresponding to the back of the information inputting person 10 or the like can be used as the reference point P_0." (*Id.*, 20:44-47.) "[W]hen the information inputting person 10 changes his/her attitude from an upright standing attitude . . . into an attitude of pointing with the hand to the display 12 . . . the determination that the information inputting person 10 is making a pointing motion is determined." (*Id.*, 21:4-9.) "[A] feature point P_X of the information inputting person 10 in the image A is extracted . . . and the position (X_A, Y_A) of the feature point P_X on the image A is calculated. The point corresponding to the fingertip pointing to the display 12 or the like can be used as the feature point P_X of the information inputting person 10." (*Id.*, 21:13-20.) The same feature point extraction is performed with image B. (*Id.*, 21:55-67.) "[T]he three-dimensional coordinates (X_X,

Y_X, Z_X) of the feature point P_X are calculated on the basis of the three-dimensional coordinates of the common lattice points extracted from the images A and B." (*Id.*, 22:33-37.) "[B]ased on the three-dimensional coordinates of the reference point P_0 of the information inputting person . . . and the three-dimensional coordinates of the feature point P_X . . . the direction of an extended virtual line (see virtual line 54 in FIG. 11) connecting the reference point and the feature point is determined as the direction pointed to by the information inputting person 10, and the coordinates (plane coordinate) of the intersection point (see point S in FIG. 11) of the plane, including the display surface of the large-screen display 12, and the virtual line are calculated in order to determine the position pointed to by the information inputting person 10." (*Id.*, 22:38-50.) After calculation of the pointing direction and pointing coordinates, "whether or not the information inputting person 10 makes the click motion is determined," where "the click motion is defined as any motion of the hand of the information inputting person (for example, bending and turning a wrist, bending and extending a finger or the like.)" (*Id.*, 22:66-23:3.) Using these steps, a user may interact with a display (e.g., a map installed in a building) by pointing and clicking. (*Id.*, 24:1-22.) FIG. 11A of *Harakawa*, which illustrates an aerial view of the pointing direction determination, is reproduced below.

FIG. 11A



(*Id.*, FIG. 11A.)

Because *Harakawa* relates to optical sensing of human inputs using a personal computing device, *Harakawa* is in the same or similar technical field as *Liebermann* and the '431 patent, and a POSITA would have had reason to consider the teachings of *Harakawa* when implementing the *Liebermann* system. (*Supra* Sections III.A, V.A.1; Ex. PA-DEC, ¶¶ 67-70.) To the extent *Harakawa* is not within the field of endeavor of the '431 patent, *Harakawa* is reasonably pertinent to problems associated with accurate determination of the orientation of objects in optical sensing systems, problems with which the inventor was involved. (*Supra* Sections III.A, V.A.1; Ex. PA-DEC, ¶¶ 67-70.)

2. Claim 20

a. A method according to claim 14, wherein said information includes the pointing direction of the portion or object.

Liebermann in view of *Harakawa* discloses or suggests the limitations recited in claim 20. (Ex. PA-DEC, ¶¶ 163-169.) As discussed for claim 20 in SNQ1 above, *Liebermann* discloses or suggests the limitations recited in claim 20. (Section V.A.20.) To the extent that "said information includes the pointing direction of the portion or object" is read to require a vector determination, a POSITA would have found it obvious to modify *Liebermann* in view of *Harakawa*. (Ex. PA-DEC, ¶ 163.)

A POSITA would have understood from *Liebermann*'s disclosures that *Liebermann* discloses or suggests determining the three-dimensional coordinates of a point on the signing user's hands. (Ex. PA-DEC, ¶ 164.) For instance, as discussed for claims 16 and 17 in SNQ1, *Liebermann* discloses determining the coordinate position of a point on the deaf user's hands (Section V.A.16) as well as the change in position (i.e., the movement) of a point on the deaf user's hands (Section V.A.17). As discussed for claim 4 in SNQ1, *Liebermann* also discloses or suggests sensing movement in three dimensions with the aid of a three-dimensional camera. (Section V.A.5.) Thus, for the same reasons discussed for claims 16-17 and claim 4, a POSITA would have found it obvious to determine a three-dimensional point on a user's hands (and the change in three-dimensional point, i.e., the movement)) in the *Liebermann* method and would have been motivated and had a reasonable expectation of success in making such a modification. (Sections V.A.16-17, V.A.5; Ex. PA-DEC, ¶ 164.) While *Liebermann* does not expressly disclose that the three-dimensional coordinates are used to determine a vector of the deaf user's hand, such a vector determination would have been obvious in view of *Harakawa*. (Ex. PA-DEC, ¶ 164.)

Harakawa discloses using the three-dimensional coordinates of a point on the user's hands, similar to as taught by *Liebermann*, and a reference point on the user's body in order to determine a pointing vector towards the display. (Section V.B.1; Ex. PA-DEC, ¶ 165.) In particular, "the three-dimensional coordinates, (x_0, y_0, z_0) of a reference point P_0 of the information inputting person 10" are determined, where " the point . . . corresponding to the back of the information inputting person 10 or the like can be used as the reference point P_0." (Ex. PA-2, 20:44-47.) In addition, "the three-dimensional coordinates (X_X, Y_X, Z_X) of the feature point P_X are calculated," where the feature point may be "[t]he point corresponding to the fingertip pointing to the display 12 or the like." (*Id.*, 21:13-20, 22:23-37.) "[B]ased on the three-dimensional coordinates of the reference point P_0 of the information inputting person . . . and the three-dimensional coordinates of the feature point P_X . . . *the direction of an extended virtual line . . . connecting the reference*

point and the feature point is determined as the direction pointed to by the information inputting person 10, and the coordinates (plane coordinate) of the intersection point . . . of the plane, including the display surface of the large-screen display 12, and the virtual line are calculated in order to determine the position pointed to by the information inputting person 10." (*Id.*, 22:38-50.) *Harakawa* discloses that these determinations allow the user to make a clicking motion, such as "bending and turning a wrist, bending and extending a finger or the like," in order to interactively communicate with a display. (*Id.*, 22:66-23:3.)

A POSITA would have found it obvious to modify the *Liebermann* method to calculate a pointing vector as in *Harakawa*. (Ex. PA-DEC, ¶ 166.) *Liebermann* discloses determining three-dimensional coordinates of a hand, as described above. (*Id.*) *Liebermann* also discloses capturing images of the signing user's body. (Ex. PA-1, 6:2-6 ("the camera lens 10 will record the signing movement of the . . . body"), 7:44-9:27 (disclosing an algorithm for feature tracking, which detects the location of various parts of the head, torso, arms, and legs).) Thus, a POSITA would have understood that the existing methods from *Liebermann* would have been used to determine three-dimensional coordinates of both a reference point (such as the user's back) and a feature point (such as a fingertip on the user's hand), similar to as taught in *Harakawa*. (Section V.A.7; Ex. PA-DEC, ¶ 166.) Then, the "direction of an extended virtual line" (i.e., a vector) would have been determined using the three-dimensional coordinates of the reference and feature points. (Ex. PA-DEC, ¶ 166; Ex. PA-2, 22:38-50.) A POSITA would have been motivated to combine *Liebermann* and *Harakawa* for use in at least two circumstances. (Ex. PA-DEC, ¶ 166.)

First, a POSITA would have recognized that implementing the vector determination would have beneficially enhanced the modified system's ability to distinguish between similar signs, thereby increasing the accuracy of sign detection. (*Id.*, ¶ 167.) As explained for claim 4, various signs involve pointing in different directions, such that two signs may resemble each other in all ways except the direction of pointing. (Section V.A.5.) Thus, a POSITA would have understood that implementing a vector determination in the *Liebermann* method would help quickly and accurately distinguish between similar looking signs that involve pointing in different directions. (Ex. PA-DEC, ¶ 167.)

Second, a POSITA would have understood that the pointing vector determination and corresponding clicking motion of *Harakawa* would be beneficial in controlling the display of the *Liebermann* device. (*Id.*, ¶ 168.) *Liebermann* discloses that the visual display of the deaf user's

device may include "*touchless function buttons*, system status indicators, alarms, a printed translation, and a playback of the image being recorded, as well as the signing images and text of the hearing person's responses." (Ex. PA-1, 6:31-36, FIG. 8 (disclosing a "function select tool bar").) A POSITA looking to implement *Liebermann*'s touchless function buttons would have recognized that incorporating a pointing vector and clicking method, similar to as taught by *Harakawa*, would have beneficially enabled the user to use her hand as a pointing and clicking device for selecting *Liebermann*'s touchless function buttons or other areas on the display. (Ex. PA-DEC, ¶ 168.)

A POSITA would have had a reasonable expectation of success in implementing either of these modifications given that the modifications would have involved implementing the algorithm taught by *Harakawa* in *Liebermann*'s device according to well-known computer programming principles. (*Id.*, ¶ 169.) Moreover, a POSITA would have had the skill to implement, and expectation of success in achieving, such modifications because they would have involved a combination of known technologies (e.g., coordinate-based gesture detection systems (*Liebermann*)) according to known methods (e.g., methods of determining a gesture based on three-dimensional coordinates (*Harawaka*)) to yield the predictable result of a process as discussed above to produce accurate gesture detection for pointing signs, as well as touchless button functionality. (*Id.*, ¶ 169.) *See KSR Intern. Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007).

C. SNQ3: *Liebermann* in view of *Maruno*

As explained below and in the attached declaration of Dr. Abowd (Ex. PA-DEC), *Liebermann* in view of *Maruno* discloses or suggests the limitations of claims 9, 10, 22, and 23 of the '431 patent. (Ex. PA-DEC, ¶¶ 63-66, 71-75, 170-180.)

1. Overview of *Maruno*

Maruno "relates to an interface apparatus . . . having display such as computer, word processor, information appliance and television, comprising recognizing means for recognizing the shape or move of the hand of an operator, display means for displaying the features of the shape or move of the hand . . . , and control means for controlling the information displayed in the screen by the special shape . . . ." (Ex. PA-3, Abstract.) *Maruno* discloses embodiments "relat[ing] to examples of manipulation on two-dimensional [virtual] images shown on the display screen," as well as an "embodiment relat[ing] to manipulation of a virtual three-dimensional image shown

on a two-dimensional display screen" or on a three-dimensional display screen. (*Id.*, 11:16-21 (describing the first three embodiments as relating to manipulation of two-dimensional images, and the fourth embodiment as relating to manipulation of a three-dimensional image on a two-dimensional display); *see also id.*, 11:66, 14:24 (discussing use of a three-dimensional display for the fourth embodiment).)

For example, in one of the two-dimensional virtual image manipulation embodiments, *Maruno* describes how "when the user confronts the appliance incorporating the interface apparatus of the embodiment and points out one finger of the hand, the arrow cursor appearing on the display moves . . . corresponding to the move of the hand." (*Id.*, 7:33-38.) When the hand moves to "one of the virtual switches 204, 205, 206 shown on the display 2, the arrow cursor is moved, and when the hand is gripped to form a fist, the one of the virtual switches 204, 205, 206 is selected, and an instruction is given to the host computer 1." (*Id.*, 7:38-43.) This virtual switch manipulation is shown below in FIG. 8.

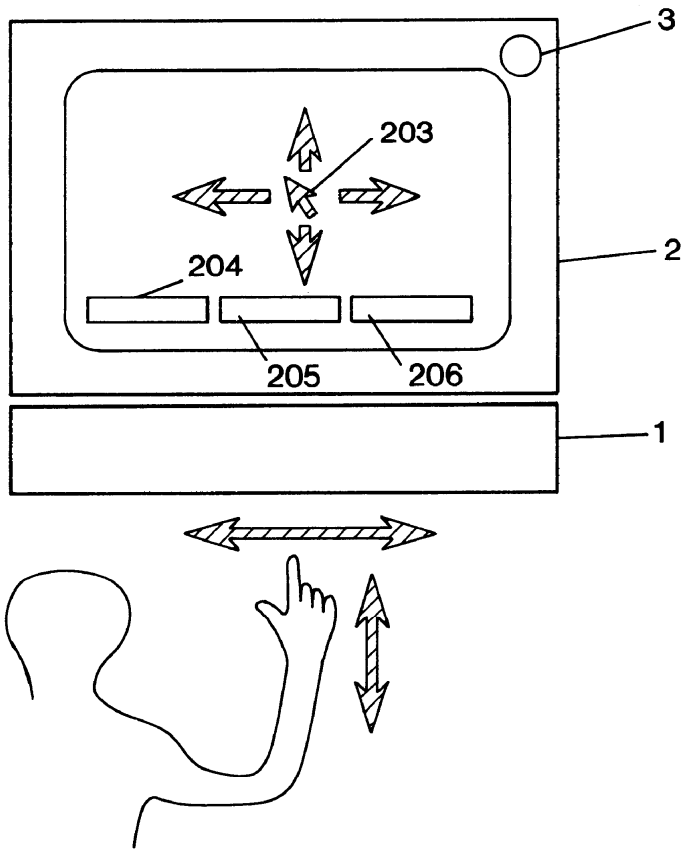


FIG. 8

(*Id.*, FIG. 8.)

In a three-dimensional image manipulation embodiment of the interface apparatus, shown in FIG. 21 below, Maruno describes "grasp[ing] a virtual object in a virtual space by using a cursor, in a displayed virtual three-dimensional space." (*Id.*, 11:23-25.) *Maruno* discloses using "cursors in two-finger manipulator shape that can be expressed from the shape of the hand of the operator." (*Id.*, 11:29-32.) FIG. 22, as shown below, portrays example finger states for the two-finger cursor. (*Id.*, 11:29-36, FIG. 22.)

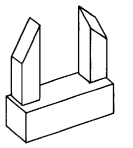


FIG. 22(A)

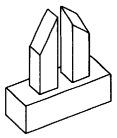


FIG. 22(B)

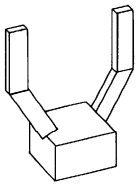


FIG. 22(C)

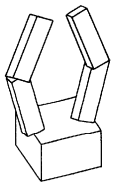


FIG. 22(D)

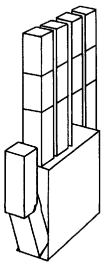


FIG. 22(E)

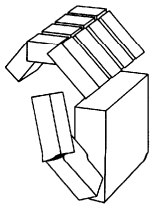


FIG. 22(F)

(*Id.*, FIG. 22.) *Maruno* also discloses a virtual object in virtual space, and describes how "when the virtual object contacts between two fingers of cursor, it is judged that the cursor has grabbed the virtual object, and thereafter the coordinates of the object are changed according to the move of the cursor." (*Id.*, 11:54-60.) "[T]he cursor can be controlled with ease by hand gesture or the like by the operator in the virtual space without making contact." (*Id.*, 12:12-14.) *Maruno* further discloses that the display means of the interface apparatus may "show[] the cursor and virtual object in two-dimensional display or three-dimensional display." (*Id.*, 14:19-30.)

Maruno discloses that all embodiments of the interface apparatus have been "explained by referring to the action of grabbing the virtual object by using the cursor as interaction," but also discloses that "similar handling is also possible in other motions, such as indicating (pointing) to the virtual object, collision, friction, impact, and remote control." (*Id.*, 19:8-12.) *Maruno* describes how "[s]imilar [virtual object manipulation] effects are obtained if the virtual space is a two-dimensional space or if the display means is a three-dimensional display," and that such manipulation "may be realized by using hardware, or by using the software on the computer." (*Id.*, 19:12-16.)

Because *Maruno* relates to display interfaces for personal computing systems that perform optical sensing of human inputs, *Maruno* is in the same or similar technical field as *Liebermann* and the '431 patent, and a POSITA would have had reason to consider the teachings of *Maruno* when implementing the *Liebermann* system. (*Supra* Sections III.A, V.A.1; Ex. PA-DEC, ¶¶ 71-75.) To the extent *Maruno* is not within the field of endeavor of the '431 patent, *Maruno* is reasonably pertinent to problems associated with controlling display of information in optical sensing systems based on human inputs, problems with which the inventor was involved. (*Supra* Sections III.A, V.A.1; Ex. PA-DEC, ¶¶ 71-75.)

2. Claim 9

a. Apparatus according to claim 7, further including a display function which is controlled.

Liebermann in view of *Maruno* discloses or suggests the limitations recited in claim 9. (Ex. PA-DEC, ¶¶ 171-174.) As described for claim 9 of SNQ1 (*see* Section V.A.10), *Liebermann* discloses or suggests the limitations recited in claim 9 under PO's interpretation that no construction is required for this term, which is consistent with the district court's construction order. (Sections IV.G.4, V.A.10.) When construed under 35 U.S.C. § 112, ¶ 6 according to Requester's construction, *Liebermann* in view of *Maruno* discloses or suggests "a computer programmed to (1) move a slider on the display as disclosed at 13:54-67 [of the '431 patent], (2) turn a knob on the display as disclosed at 13:63-14:9 [of the '431 patent], *or* (3) throw a switch on the display as disclosed at 13:63-67 [of the '431 patent]." (Section IV.G.4; Ex. PA-DEC, ¶ 171.) In particular, *Liebermann* in view of *Maruno* discloses or suggests "a computer programmed to (1) move a slider on the display as disclosed at 13:54-67 [of the '431 patent] . . . [and] (3) throw a

switch on the display as disclosed at 13:63-67 [of the '431 patent]." (Section IV.G.4; Ex. PA-DEC, ¶ 171; Ex. PAT-A, 13:54-67.)

Maruno discloses a variety of cursor movements that may be used to interact with and manipulate virtual images on a screen. (*See generally* Ex. PA-3.) In a two-dimensional image manipulation embodiment, *Maruno* discloses moving an arrow cursor corresponding to the move of a hand and using it to select a "virtual switch" on a two-dimensional display, which gives an instruction to the host computer. (Ex. PA-3, 7:33-43.) In a three-dimensional image manipulation embodiment, *Maruno* discloses "grasp[ing] a virtual object in a virtual space by using a cursor" with either a two- or three-dimensional display. (*Id.*, 11:16-25, 11:66, 14:24.) *Maruno* also describes how "when the virtual object contacts between two fingers of cursor, it is judged that the cursor has grabbed the virtual object, and thereafter the coordinates of the object are changed according to the move of the cursor." (*Id.*, 11:54-60; 14:19-30.) *Maruno* further explains that while all of the disclosed embodiments "have been explained by referring to the action of grabbing the virtual object by using the cursor as interaction, . . . similar handling is also possible in other motions, such as indicating (pointing) to the virtual object, collision, friction, impact, and remote control." (*Id.*, 19:8-12.) Because *Maruno* discusses using this "similar handling" (e.g., pointing to the virtual object instead of grabbing) in *all* embodiments (regardless of whether two- or three-dimensional image manipulation/display is used), and because *Maruno* discloses that "similar [virtual object manipulation] effects are obtained if the virtual space is a two-dimensional space *or* if the display means is a three-dimensional display," a POSITA would have recognized that *Maruno*'s disclosed virtual image manipulation techniques are widely applicable across display types. (*Id.*, 19:8-16; Ex. PA-DEC, ¶ 172.) That is, a POSITA would have recognized that the *Maruno* technique would have been used for moving a cursor, selecting a virtual switch, grabbing a virtual object, and moving a virtual object using a variety of hand gestures or pointing motions, regardless of display type or whether virtual images are displayed in two- or three-dimensional space. (Ex. PA-DEC, ¶ 172.)

A POSITA would have recognized that the *Maruno* technique would have been an ideal and flexible choice for implementing *Liebermann*'s touchless function buttons to enable a signing user to interact with the display. (Ex. PA-DEC, ¶ 173; Ex. PA-1, 6:31-36 (describing touchless function buttons), FIG. 8 (showing a function select tool bar).) For example, a POSITA would have understood the benefits of programming the *Liebermann* cellular phone computer to

implement a virtual switch, as described in *Maruno*, for each of the touchless function buttons on the function select tool bar, as shown in FIG. 8 below. (Ex. PA-DEC, ¶ 173.)

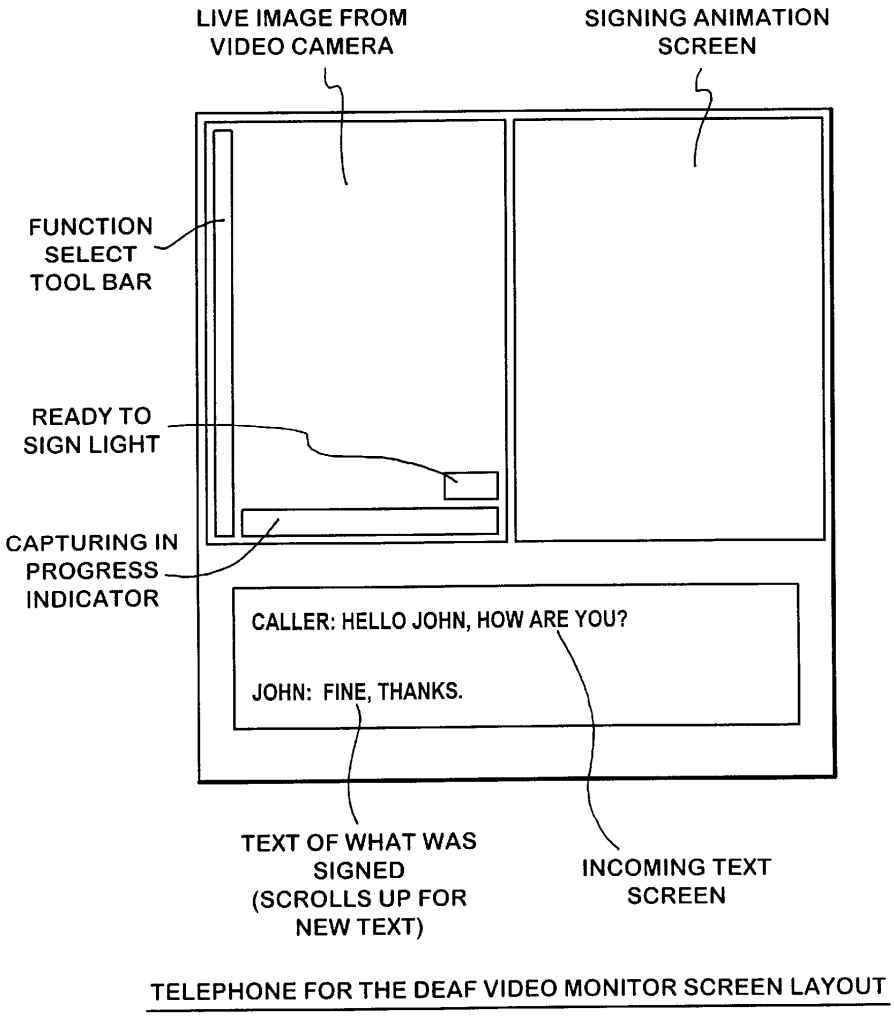


FIG. 8

(Ex. PA-1, FIG. 8.) A POSITA would have been motivated from *Maruno*'s disclosures to configure the modified apparatus such that a virtual switch was moved (e.g., moved from an off to an on position) using a cursor (e.g., finger pointing) to select the virtual switch, grab it, and move it. (Ex. PA-DEC, ¶ 173.) In this way, the *Liebermann* cellular phone computer would be programmed to "throw a switch on the display as disclosed at 13:63-67 [of the '431 patent]." (*Id.*; Ex. PAT-A, 13:63-67 (describing pointing at a virtual object on a display in order to throw a switch).) Similarly, a POSITA would have understood the benefits of programming the *Liebermann* cellular phone computer to implement a manual scroll feature on the incoming text

screen to allow the signing user to scroll through past conversation, as well as a manual scroll feature on the function select tool bar to allow the user to scroll through an assortment of selectable function buttons. (Ex. PA-DEC, ¶ 173; Ex. PA-1, FIG. 8 (reproduced above and showing an incoming text box and function select tool bar).) A POSITA would have recognized that moving a virtual object, as described in *Maruno*, would be an ideal way to implement these virtual slider functions. (Ex. PA-DEC, ¶ 173.) In this way, the *Liebermann* cellular phone computer would be programmed to "move a slider on the display as disclosed at 13:54-67 [of the '431 patent]." (*Id.*, ¶ 173; Ex. PA-1, 13:54-67 (describing pointing at a display to operate a virtual slider function).)

A POSITA would have had a reasonable expectation of success in implementing this modification because the *Maruno* technique involves detection of the position and movement of pointing or other hand gestures, which the *Liebermann* method is already capable of detecting. (Ex. PA-3, 12:12-14 (discussing *Maruno* hand gestures), 19:8-12 (discussing *Maruno* finger pointing); *see generally* Section V.A (discussing *Liebermann*'s detection of hand and finger gestures); *see also* Section V.A.16-17 (describing how the *Liebermann* method detects the position and change in position of a hand/finger); Ex. PA-DEC, ¶ 174.) A POSITA would have also had the skill to implement, and expectation of success in achieving, such a modification because it would have involved applying known technologies (e.g., known gesture detection technology (*Liebermann*)) according to known methods (e.g., known virtual object control techniques (*Maruno*)) to yield the predictable result of a cellular phone with its internal computer programmed to control a display function that involves moving a virtual slider or throwing a virtual switch. (Ex. PA-DEC, ¶ 174.) *See KSR Intern. Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007). Thus, *Liebermann* in view of *Maruno* discloses or suggests Requester's claim 9 construction under 35 U.S.C. § 112, ¶ 6.

Accordingly, *Liebermann* in view of *Maruno* discloses or suggests the limitations recited in claim 9 under Requester's proposed construction for the claimed "display function." (*See* Section IV.G.4.)

3. Claim 10

a. Apparatus according to claim 9, wherein said display is 3D display.

Liebermann in view of *Maruno* discloses or suggests the limitations recited in claim 10. (Ex. PA-DEC, ¶¶ 175-178.) As discussed above in Section V.C.2, *Liebermann* discloses or suggests the limitations recited in claim 9 under PO's interpretation that no construction is required for this term, and *Liebermann* in view of *Maruno* discloses or suggests these limitations under Requester's interpretation under 35 U.S.C. § 112, ¶ 6. (*See* Sections V.C.2, V.A.10.) *Liebermann* further discloses that when a hearing person responds to the signing user's communication, the speech is translated back to signs. (Ex. PA-1, 5:14-34.) "The sign images then appear on the screen of a monitor viewed by the deaf person, resulting in a continuous dynamic set of animated sign language motions which portray the content of the spoken language uttered as speech by the normally hearing person." (*Id.*, 5:30-34.) While *Liebermann* does not expressly disclose that the animated sign language motions are displayed on a "3D display," such a feature would have been obvious in view of *Maruno*. (Ex. PA-DEC, ¶ 175.)

Maruno discloses that the display means of the interface apparatus may "[s]how the cursor and virtual object in . . . three-dimensional display." (Ex. PA-3, 14:19-30, 19:14 (disclosing that the "display means [may be] a three-dimensional display"), 11:66-67 (addressing "the case of using the three-dimensional display device").) In view of *Maruno*, a POSITA would have been motivated to project the screen animations of *Liebermann* on a three-dimensional display, similar to as taught by *Maruno*. (Ex. PA-DEC, ¶ 176.) Such a modification would have beneficially enhanced both the user experience and the amount of information that may be conveyed through animation. (*Id.*) For instance, *Liebermann* discloses that ASL incorporates "information about the handshape (Stokoe's 'dez'), the motion (Stokoe's 'sig') and the spatial location of the hands relative to the rest of the body (Stokoe's 'tab'.)" (Ex. PA-1, 10:60-64 (internal quotations added).) A POSITA would have understood that because the motion component ("sig") of a sign can involve a hand moving in the depth direction (i.e., from the signing user towards the cellular phone display), the ability to convey depth through a three-dimensional display would be beneficial. (Ex. PA-DEC, ¶ 176.)

A POSITA would have further understood from *Maruno*'s disclosures that the implementation of a three-dimensional display would not affect the ability for the signing user to control a display function, as described in claim 9. (Ex. PA-DEC, ¶ 177; Section V.C.2.) As described in Section V.C.2 above, *Maruno* suggests that its virtual object manipulation and display control techniques are versatile and would have been implemented using either two- or three-

dimensional display hardware. (Section V.C.2.) Thus, a POSITA would have been motivated to configure the *Liebermann* cellular phone to obtain the predictable benefits of a three-dimensional display without sacrificing the display control functionality. (Ex. PA-DEC, ¶ 177.)

A POSITA would have had a reasonable expectation of success in implementing this modification because *Maruno* suggests that the three-dimensional display interface apparatus is suitable to portable devices. (Ex. PA-3, 1:30-35 (distinguishing the present invention from a more conventional interface apparatus, "which is not suited to portable information appliance or the like"); Ex. PA-DEC, ¶ 178.) Moreover, a POSITA would have had the skill to implement, and expectation of success in achieving, such a modification because it would have involved applying known technologies (e.g., known gesture detection technology (*Liebermann*)) and materials (e.g., known three-dimensional displays (*Maruno*)) according to known methods (e.g., known three-dimensional gesture detection techniques) to yield the predictable result of a three-dimensional display implemented within a sign language communication system and providing display functions. (*Id.*) *See KSR Intern. Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007).

4. Claim 22

a. A method according to claim 21, wherein a virtual image on said display is moved or changed.

Liebermann in view of *Maruno* discloses or suggests the limitations recited in claim 22. (Ex. PA-DEC, ¶ 179.) *Liebermann* in view of *Maruno* discloses or suggests these limitations for similar reasons as explained for claim 9 of SNQ3 in Section V.C.2. (Section V.C.2.) Section V.C.2 explains how a POSITA would have found it obvious to modify the *Liebermann* cellular phone so that virtual image manipulation techniques, similar to those described in *Maruno*, would be used to implement touchless function buttons or a slider control. (*Id.*) As described, this modification would have involved moving a virtual image on the display, as required by claim 21. (*Id.*; Ex. PA-DEC, ¶ 179.)

5. Claim 23

a. A method according to claim 21, wherein said display is a 3D display.

Liebermann in view of *Maruno* discloses or suggests the limitations recited in claim 23. (Ex. PA-DEC, ¶ 180.) *Liebermann* in view of *Maruno* discloses or suggests these limitations for similar reasons as explained for claim 10. (Section V.C.3; Ex. PA-DEC, ¶ 180.)

D. SNQ4: *Liebermann* in view of *Maruno* and *Maguire*

As explained below and in the attached declaration of Dr. Abowd (Ex. PA-DEC), *Liebermann* in view of *Maruno* and *Maguire* discloses or suggests the limitations of claim 24 of the '431 patent. (Ex. PA-DEC, ¶¶ 63-66, 71-79, 181-186.)

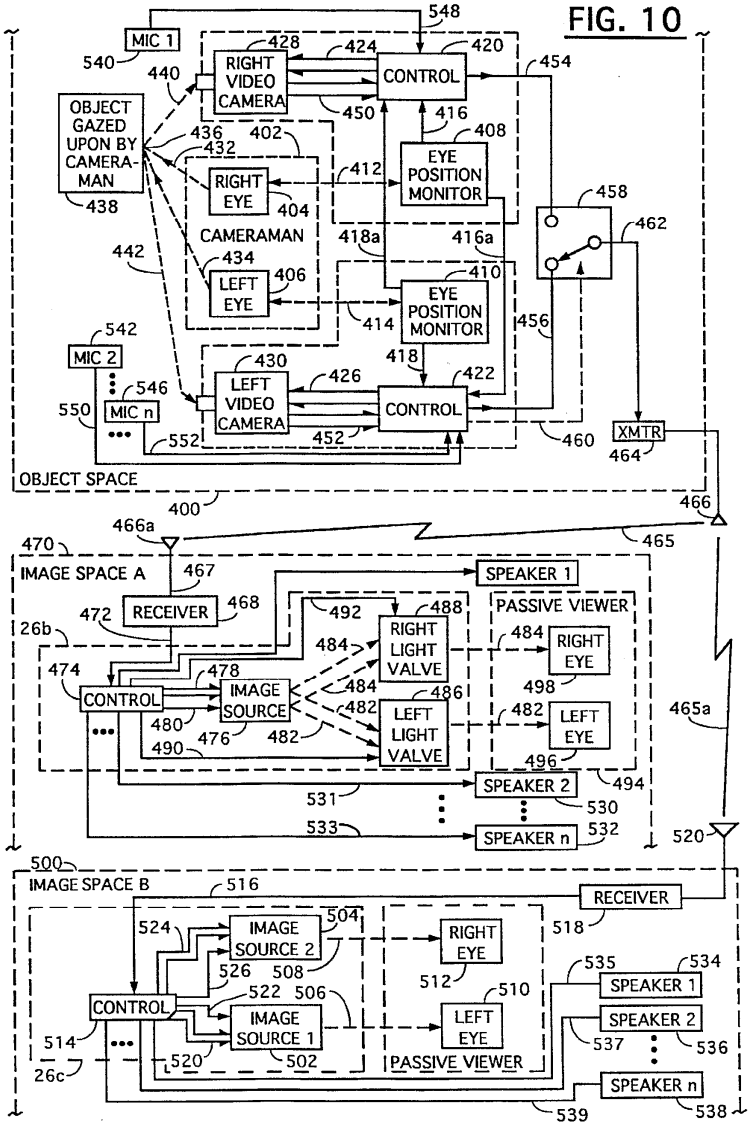
1. Overview of *Maguire*

Maguire discloses "[a] method and apparatus for providing, in response to successive image signals and a control signal, the successive images at various apparent distances," where "[t]he images may be provided stereoscopically." (Ex. PA-4, Abstract.) *Maguire* describes prior art virtual reality applications and addresses the ways in which the present invention aims to solve issues with these applications. (*Id.*, 1:10-58.) For example, *Maguire* describes how "[v]irtual reality, immersive simulation, artificial reality, telepresence, virtual world, virtual environment and similar terms are used to describe a viewer-display interface in which successive images are presented and controlled as to content by gestures, by walking around, looking around and using the viewer's hands to simulate the manipulation of objects." (*Id.*, 1:10-16.) *Maguire* also describes "a static kind of virtual reality . . . provided by the parlor stereoscope" that "was used to present stereograms taken from differing perspectives corresponding to the separation between human eyes, more or less, to provide a striking illusion of depth." (*Id.*, 1:27-31.) However, *Maguire* notes that these applications cause visual discomfort to the user, and that it would be advantageous to provide similar techniques without such discomfort. (*Id.*, 1:10-34.) *Maguire* also describes how prior art virtual reality systems would be improved by "speed[ing] up the process and reduc[ing] or eliminat[ing] the lag." (*Id.*, 1:47-58.)

In FIG. 10, reproduced below, *Maguire* discloses "a stereoscopic camera and two stereoscopic display embodiments of the present invention." (*Id.*, 10:64-66.) In the first of these embodiments (top image), the object space 400 contains a cameraman 402 that has both eyes 404, 406 monitored by eye position monitors 408, 410 via signal lines 412, 414. (*Id.*, 10:64-11:6.) The eye position monitors, which "measure one or more axes of rotation of the eye," each "provides at least one eye position signal 416, 418 to respective control units 420, 422, which in turn provide

scanning control signal lines 424, 426 to respective video cameras 428, 430." (*Id.*, 11:6-12.) *Maguire* further explains that in this stereoscopic arrangement, "[e]ach of the cameras 428, 430 provides a video signal, respectively, on lines 450, 452 to the control units 420, 422, where the image information is formatted, without limitation, into composite video signals on lines 454, 456, respectively." (*Id.*, 12:13-17.) *Maguire* also features "[a] switch 458 [that] is controlled by a signal line 460 from the control unit 422 (or control unit 420) to alternate between signal lines 454 and 456 in order to provide each signal alternately on a line 462 to a transmitter 464 for transmission of a broadcast signal on a line 465 via an antenna 466. The time of the alterations of switch 458 may be selected so as to provide a left field, frame or portion thereof and then a right counterpart." (*Id.*, 12:19-27.)

FIG. 10



(*Id.*, FIG. 10.)

In the related embodiment of FIG. 4, which also shows a passive viewer being presented successive images, *Maguire* discloses that the "video signal ultimately provided on the line . . . may be formed in a manner" different from described above. (*Id.*, 7:3-5.) In particular, "the object space need not be real and the image signals may be formed by means of traditional or computer animation, without using a cameraman and without monitoring any of [the user's] eyes." (*Id.*, 7:5-9). *Maguire* further discloses that in such an arrangement, image signals "may be constructed by means of a computer." (*Id.*, 7:11-12; *see also id.*, 3:28-29 (describing FIG. 4), 3:45-46 (describing FIG. 10).)

Because *Maguire* relates to camera and display techniques for use with optical sensing of human inputs (such as gestures or manipulations), *Maguire* is in the same or similar technical field as *Liebermann* and the '431 patent, and a POSITA would have had reason to consider the teachings of *Maguire* when implementing the *Liebermann* system. (*Supra* Sections III.A, V.A.1; Ex. PA-DEC, ¶¶ 76-79.) To the extent *Maguire* is not within the field of endeavor of the '431 patent, *Maguire* is reasonably pertinent to problems associated with sensing and display of information in systems that perform optical sensing of human inputs, problems with which the inventor was involved. (*Supra* Sections III.A, V.A.1; Ex. PA-DEC, ¶¶ 76-79.)

2. Claim 24

a. A method according to claim 23, wherein said display is a stereoscopic display.

Liebermann in view of *Maruno* and *Maguire* discloses or suggests the limitations recited in claim 24. (Ex. PA-DEC, ¶¶ 182-186.) As discussed for claim 23, *Liebermann* in view of *Maruno* discloses or suggests "wherein said display is a 3D display." (Section V.C.4.) *Maruno* does not expressly disclose that "said display is a stereoscopic display." Such a feature, however, would have been obvious in view of *Maguire*.

Maguire discloses "[a] method and apparatus for providing, in response to successive image signals and a control signal, the successive images at various apparent distances," where "[t]he images may be provided stereoscopically." (Ex. PA-4, Abstract.) In one embodiment, *Maguire* discloses, in connection with Figure 10, stereoscopic camera and stereoscopic display elements. (*Id.*, 10:64-66.) In particular, the object space 400 contains a cameraman 402 that has

both eyes 404, 406 monitored by eye position monitors 408, 410 via signal lines 412, 414. (*Id.*, 10:64-11:6.) The eye position monitors, which "measure one or more axes of rotation of the eye," each "provides at least one eye position signal 416, 418 to respective control units 420, 422, which in turn provide scanning control signal lines 424, 426 to respective video cameras 428, 430." (*Id.*, 11:6-12.) *Maguire* further explains that in this stereoscopic arrangement, "[e]ach of the cameras 428, 430 provides a video signal, respectively, on lines 450, 452 to the control units 420, 422, where the image information is formatted, without limitation, into composite video signals on lines 454, 456, respectively." (*Id.*, 12:13-17.) Thus, *Maguire* discloses "a stereoscopic display," as claimed. (Ex. PA-DEC, ¶ 183.)

A POSITA would have been motivated to implement a stereoscopic display similar to that described in *Maguire* in the combined *Liebermann-Maruno* system. (*Id.*, ¶ 184.) As discussed for claims 10 and 23, a POSITA would have found it obvious to implement a three-dimensional display in the *Liebermann* cellular phone in order to enhance the display of signing animation. (Sections V.C.3, V.C.5.) Likewise, a POSITA would have understood that the *Maguire* stereoscopic display would be suitable to the display of animation. (Ex. PA-DEC, ¶ 184.) In a related embodiment of FIG. 4, which also shows a passive viewer being presented successive images, *Maguire* discloses that the video signal provided on the line "may be formed by . . . computer animation, without using a cameraman" and that image signals may be constructed by computer. (Ex. PA-4, 7:3-12; *see also id.*, 3:28-29 (describing FIG. 4), 3:45-46 (describing FIG. 10).) Thus, a POSITA would have recognized that a stereoscopic display would be capable of displaying the phone's computer animation output without altering the camera arrangement of the *Liebermann* cellular phone. (Ex. PA-DEC, ¶ 184.)

A POSITA would have further recognized the benefits of using a stereoscopic display for the display of signing animation. (*Id.*, ¶ 185.) *Maguire* describes that prior art virtual reality applications may have various issues, especially "discomfort in the viewer's eyes" that makes "such a presentation of successive images hard to accept and . . . not easy to look at, especially for long periods," and provides a display to eliminate such discomfort. (Ex. PA-4, 1:10-46.) "Virtual reality also suffers from very high speed demands," so *Maguire* aims to provide a display that "speed[s] up the process and reduce[s] or eliminate[s] the lag." (*Id.*, 1:47-58.) Since *Maruno* discloses a virtual reality application with a three-dimensional display, and since *Maguire* discloses how the stereoscopic display improves upon known issues with virtual reality

applications, a POSITA would have understood the benefits of implementing a *stereoscopic* type of three-dimensional display in the *Liebermann* cellular phone. (Ex. PA-DEC, ¶ 185.) A POSITA would have also understood that this stereoscopic display could be controlled by implementing similar three-dimensional display control techniques as disclosed in *Maruno*, and as described for claims 10 and 23. (*Id.*; Sections V.C.3, V.C.5.)

A POSITA would have had a reasonable expectation of success in implementing this modification because *Maguire* suggests that the stereoscopic display is suitable to gesture detection devices. (Ex. PA-4, 1:10-26 (discussing improvements to virtual reality applications that are "controlled as to content by gestures").) A POSITA would have had the skill to implement, and expectation of success in achieving, such a modification because it would have involved applying known technologies (e.g., known gesture detection technology (*Liebermann*)) and materials (e.g., known stereoscopic three-dimensional displays (*Maguire*)) according to known methods (e.g., known three-dimensional gesture detection techniques (*Liebermann*) and known methods of three-dimensional display control (*Maruno*)) to yield the predictable result of a stereoscopic display implemented within a sign language communication system and providing display functions. (Ex. PA-DEC, ¶ 186.) *See KSR Intern. Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007).

E. SNQ5: *Liebermann* in view of *Mack*

As explained below and in the attached declaration of Dr. Abowd (Ex. PA-DEC), *Liebermann* in view of *Mack* discloses or suggests the limitations of claims 10, 23, and 27 of the '431 patent. (Ex. PA-DEC, ¶¶ 63-66, 80-81, 187-196.)

1. Overview of *Mack*

Mack discloses "a method and apparatus for navigating 3-D worlds" that uses stereo imaging to capture the 3-D information of a marker on the user hand." (Ex. PA-5, 2:19-22.) "The 3-D coordinates of the marker," which may include the hand marker but also facial expressions, head movements, and eye movements, "are computed using 3-D camera geometry." (*Id.*, 2:22-26.) *Mack* discloses that "[t]he computer 110 is loaded with a 3-D processing program such as 3-D animation, game, education, and visualization." (*Id.*, 2:41-43.) The computer may connect to "one or more input/output (I/O) devices such as display monitor 120, keyboard 130, mouse, and tablet digitizer," as well as "input unit 150 for receiving 3-D information." (*Id.*, 2:45-50.) "The

display monitor 120 displays the 3-D graphic or image data as processed by the computer 110," while "[t]he input unit 150 provides a housing for the 3-D input system which provides a work area for the user hand 160." (*Id.*, 2:51-59.) The input unit 150 may include "a stereo camera system to determine the 3-D coordinates of a marker manipulated by the user. (*Id.*, 2:58-62.) *Mack* further discloses that "[t]he marker 240 is any convenient object that is used to facilitate the detection of the movement of the user's hand or finger." (*Id.*, 3:64-66.) For example, the marker may be "a specially designed object that can be worn at the tip of the user's finger." (*Id.*, 3:66-4:1.) In addition, the marker is illuminated by a light source and imaged by the stereo cameras. (*Id.*, 2:67-3:2.) *Mack*'s FIG. 1 is reproduced below and illustrates these components.

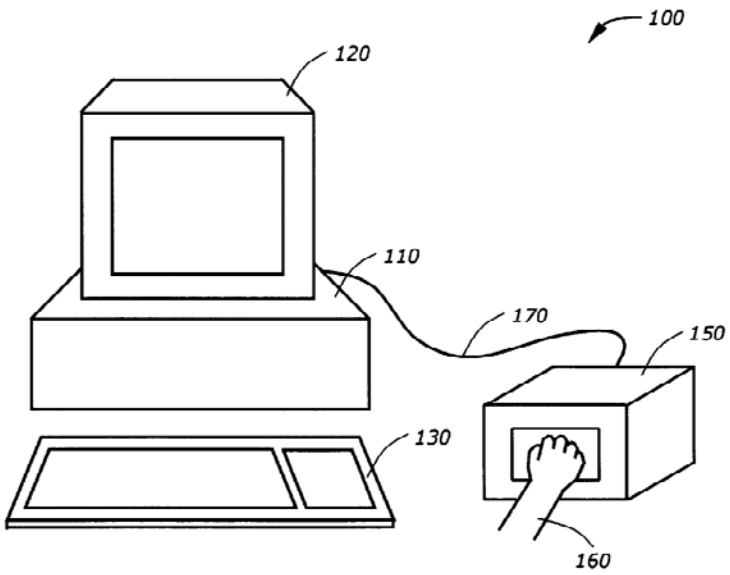


FIG. 1

(*Id.*, FIG. 1.)

Because *Mack* relates to display techniques for use with optical sensing of human inputs, *Mack* is in the same or similar technical field as *Liebermann* and the '431 patent, and a POSITA would have had reason to consider the teachings of *Mack* when implementing the *Liebermann* system. (*Supra* Sections III.A, V.A.1; Ex. PA-DEC, ¶¶ 80-81.) To the extent *Mack* is not within the field of endeavor of the '431 patent, *Mack* is reasonably pertinent to problems associated with implementing optical sensing and image analysis systems and displaying related information,

problems with which the inventor was involved. (*Supra* Sections III.A, V.A.1; Ex. PA-DEC, ¶¶ 80-81.)

2. Claim 10

a. Apparatus according to claim 9, wherein said display is 3D display.

Liebermann in view of *Mack* discloses or suggests the limitations recited in claim 10. (Ex. PA-DEC, ¶¶ 188-192.) As discussed above in Section V.A.10, *Liebermann* discloses or suggests the limitations recited in claim 9 under PO's interpretation that no construction is required for this term. (*See* Section V.A.10.) *Liebermann* further discloses that when a hearing person responds to the signing user's communication, the speech is translated back to signs. (Ex. PA-1, 5:14-34.) "The sign images then appear on the screen of a monitor viewed by the deaf person, resulting in a continuous dynamic set of animated sign language motions which portray the content of the spoken language uttered as speech by the normally hearing person." (*Id.*, 5:30-34.) While *Liebermann* does not expressly disclose that the animated sign language motions are displayed on a "3D display," such a feature would have been obvious in view of *Mack*. (Ex. PA-DEC, ¶ 188.)

Mack discloses that "[t]he display monitor 120 displays the 3-D graphic or image data as processed by the computer 110," and "provides a means for user to navigate the 3-D world as processed by the computer." (Ex. PA-5, 2:25-26, 2:51-52.) "The computer 110 is loaded with a 3-D processing program such as 3-D animation, game, education, and visualization" and may be "based on a high performance microprocessor, such as any type of Intel® microprocessor architecture." (*Id.*, 2:41-45.) *Mack* notes that such "[t]hree-dimensional (3-D) graphic and imaging systems" were well known and popular, as were "[h]igh performance processors with 3-D capabilities [that had] been developed for 3-D applications such as animation, visualization, games, and education." (*Id.*, 1:11-15.) *Mack* further discloses that the display monitor that "displays the 3-D graphic or image data" may be "any monitor, including cathode ray tube (CRT), a flat panel display, etc." (*Id.*, 2:51-54.) By using these known 3-D graphics, processor, and display components—all "commercially off-the-shelf hardware"—*Mack* discloses a method "for navigation in 3-D world" by which a three-dimensional display may be implemented to provide a "simple and efficient 3-D vision system." (*Id.*, 6:63-67.) Thus, *Mack* discloses a "3D display," as claimed. (Ex. PA-DEC, ¶ 189.)

A POSITA would have been motivated to combine the screen animation of *Liebermann* with the three-dimensional display of *Mack* in order to enhance both the user experience and the amount of information that may be conveyed through animation. (Ex. PA-DEC, ¶ 190.) For instance, *Liebermann* discloses that ASL incorporates "information about the handshape (Stokoe's dez), the motion (Stokoe's sig) and the spatial location of the hands relative to the rest of the body (Stokoe's tab.)" (Ex. PA-1, 10:60-64.) A POSITA would have understood that because the motion (Stokoe's sig) of a sign can involve a hand moving in the depth direction (i.e., from the signing user towards the cellular phone display), the ability to convey depth through a three-dimensional display would be beneficial. (Ex. PA-DEC, ¶ 190.) Furthermore, a POSITA would have been motivated to configure *Liebermann*'s apparatus to incorporate technologies similar to the *Mack* 3-D detection technology and three-dimensional display features with *Liebermann*'s apparatus (which also describes touchless function buttons to enable a signing user to interact with the three-dimensional display). (*Id.*; Ex. PA-1, 6:31-36.) *Mack* discloses using 3-D inputs from the hands to signal commands to the three-dimensional display, which a POSITA would have recognized is an ideal method to incorporate into the cellular phone of *Liebermann* to enable use of the touchless function buttons. (Ex. PA-5, 6:38-67; Ex. PA-DEC, ¶ 190.)

A POSITA would have understood that the three-dimensional display of *Mack* is applicable to the *Liebermann* cellular phone. (Ex. PA-DEC, ¶ 191.) *Mack* repeatedly discloses that the three-dimensional display involves conventional components, noting that the display may be any "flat panel display" and the 3-D vision "technique does not require major hardware modifications and can be implemented using commercially off-the-shelf hardware." (Ex. PA-5, 2:52-55, 6:65-67.) Thus, a POSITA would have been motivated to configure the LCD display of the *Liebermann* cellular phone using technology and features similar to the three-dimensional display as described by *Mack*. (Ex. PA-DEC, ¶ 191.) A POSITA would have configured the modified *Liebermann* cellular phone as discussed such that the use of a three-dimensional display would not affect the ability for the signing user to control a display function, as interpreted by PO for claim 9. (Ex. PA-DEC, ¶ 191; Section V.A.10.) *Mack* discloses "detection of the movement of the user's hand or finger." (Ex. PA-5, 3:64-66; Ex. PA-DEC, ¶ 191.) Because the display functions described for claim 9 are also initiated via hand or finger signs or movements, a POSITA would have understood that implementing the three-dimensional display of *Mack* in the *Liebermann* cellular phone would still allow the display functions to successfully operate. (Section V.A.10; Ex. PA-DEC, ¶ 191.)

A POSITA would have had a reasonable expectation of success in implementing this modification because, as described in the preceding paragraph, the modification involves implementing *Mack*'s three-dimensional display, which uses known, commercially available hardware, processor, and 3-D graphics components, in the *Liebermann* cellular phone, which a POSITA would have understood contains similar hardware and processor components. (Ex. PA-DEC, ¶ 192.) Moreover, a POSITA would have had the skill to implement, and expectation of success in achieving, such a modification because it would have involved applying known technologies (e.g., known gesture detection technology (*Liebermann*)) and materials (e.g., known three-dimensional displays (*Mack*)) according to known methods (e.g., known three-dimensional gesture detection techniques) to yield the predictable result of a three-dimensional display implemented within a sign language communication system and providing display functions. (*Id.*) *See KSR Intern. Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007). Thus, when the limitations recited in claim 9 are construed according to PO's interpretation, *Liebermann* in view of *Mack* discloses or suggests the limitations recited in claim 10. (Section V.A.10; Ex. PA-DEC, ¶ 192.)

3. Claim 23

a. A method according to claim 21, wherein said display is a 3D display.

Liebermann in view of *Mack* discloses or suggests the limitations recited in claim 23. (Ex. PA-DEC, ¶ 193.) *Liebermann* discloses or suggests these limitations for similar reasons as explained for claim 10 of SNQ6 and claim 21 of SNQ1. (Sections V.E.2, V.A.21; Ex. PA-DEC, ¶ 193.)

4. Claim 27

a. A method according to claim 14, wherein said controlled function relates to a game.

Liebermann in view of *Mack* discloses or suggests the limitations recited in claim 27. (Ex. PA-DEC, ¶¶ 194-196.) *Liebermann* does not disclose that the "controlled function relates to a game." However, this feature would have been obvious in view of *Mack*. (Ex. PA-DEC, ¶ 194.)

Mack discloses that "[t]he computer 110 is loaded with a 3-D processing program such as 3-D animation, *game*, education, and visualization." (Ex. PA-5, 2:41-43.) The computer, which

can be loaded with a 3-D game program, also has "display monitor 120 [which] displays the 3-D graphic or image data as processed by the computer 110." (*Id.*, 2:51-52; Ex. PA-DEC, ¶ 195.)

A POSITA would have found it obvious in view of *Mack* to modify the *Liebermann* cellular phone and method in order to implement a "controlled function [that] relates to a game." (Ex. PA-DEC, ¶ 196.) As described for claims 10 and 23, a POSITA would have been motivated to implement the three-dimensional display in the *Liebermann* method. (Sections V.E.2-3.) Because the 3-D game program works in conjunction with a three-dimensional display, and because a POSITA would have known that cellular phone-based games were well known at the time of the invention, a POSITA would have found implementing a game program or similar program, similar to the guidance and disclosures explained by *Mack*, in the *Liebermann* device would have been a natural extension of known three-dimensional display technologies. (Ex. PA-DEC, ¶ 196.) A POSITA would have been motivated to implement such a game features as a controlled function where the commands are signs or gestures—similar to the controlled functions explained for claim 14. (*Id.*; *see generally* Section V.A.14.) A POSITA would have had a reasonable expectation of success in implementing this modification because the modification would have involved running known 3-D processing programs in conjunction with a three-dimensional display, which a POSITA would have understood would have been implemented in the *Liebermann* cellular phone for the reasons above. (Ex. PA-DEC, ¶ 196; Sections V.E.2-3.) Moreover, a POSITA would have had the skill to implement, and expectation of success in achieving, such a modification because it would have involved applying known technologies (e.g., known gesture detection technology (*Liebermann*)) and materials (e.g., known three-dimensional displays (*Mack*)) according to known methods (e.g., known three-dimensional gesture detection techniques and known three-dimensional gaming methods) to yield the predictable result of a device control function in a cellular phone that uses gesture input and relates to a game. (*Id.*, ¶ 196.) *See KSR Intern. Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007).

F. SNQ6: *Liebermann* in view of *Pinkney*

As explained below and in the attached declaration of Dr. Abowd (Ex. PA-DEC), *Liebermann* in view of *Pinkney* discloses or suggests the limitations of claims 7-9 and 11-13 of the '431 patent. (Ex. PA-DEC, ¶¶ 63-66, 82-87, 197-211.)

1. Overview of *Pinkney*

As mentioned above, while *Pinkney* was identified in the '431 patent (Ex., PAT-A, 2:35, 3:63-4:28 (describing known photogrammetric techniques of *Pinkney*), 4:59-62 (identifying *Pinkney*'s known moment method), 24:31-34 (identifying *Pinkney*'s known photogrammetric method "described in the Pinkney references")), *Pinkney* is not identified as a "Reference[] Cited" by the Patent Office during examination of the '431 patent (*id.*, Cover (References Cited)), and the file history shows no evidence that the reference was considered as prior art during examination of the '431 patent (*generally* Ex., PAT-B (file history of the '431 patent)). Instead, the '431 patent's references to *Pinkney* acknowledge that *Pinkney* was prior art to the '431 patent, and establishes would have been available to a POSITA prior to the alleged invention for the '431 patent. Accordingly, that SNQ6 relies on *Pinkney* as a secondary prior art reference does not change that the *Liebermann* and *Pinkney* combination discussed below raises a substantial new question of patentability as discussed, especially given *Pinkney* was not considered in light of the teachings and suggestions of *Liebermann* and the expert opinion accompanying this request. (Ex. PA-DEC.)

Pinkney discloses a computer that analyzes images to determine "position, orientation, and velocity information" of various objects. (Ex. PA-6, 1:7-12.) More particularly, *Pinkney* describes a system "for evaluation in real time of a video signal to determine image plane coordinates of targeted contrast elements." (*Id.*) The system includes a computer that operates a camera 17 to view the relative position of target points. (*Id.*, 1:65-2:18.)

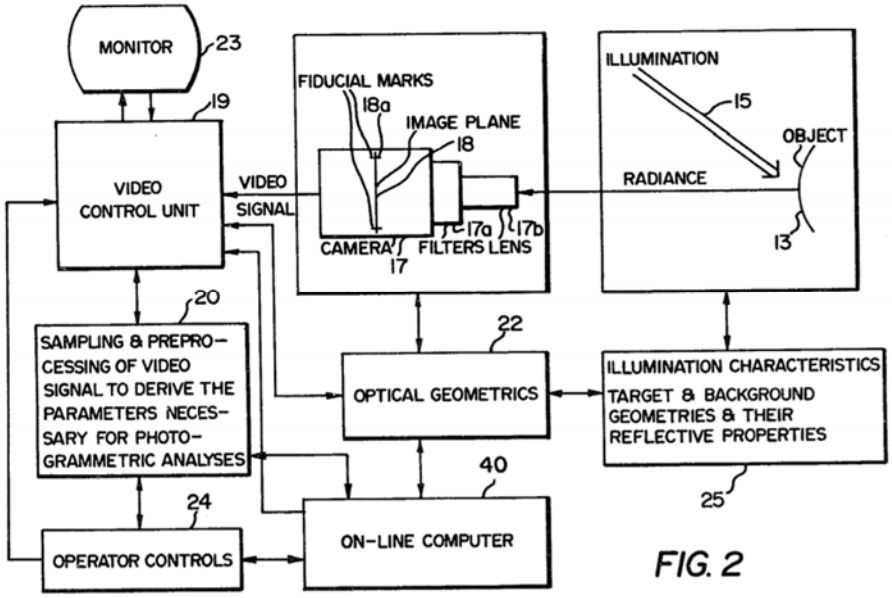


FIG. 2

(*Id.*, FIG. 2.) As illustrated in FIG. 2, camera 17 transmits a video signal to the computer with a photogrammetric resolution. (*Id.*, 2:7-18, FIG. 2.) Image data is processed using circuitry "for determining the x-y coordinates" and circuitry "for carrying out the photogrammetric calculations to provide position, orientation and velocity information." (*Id.*, 1:57-67.)

To determine position and orientation information of an imaged object, *Pinkney* explains that any two-dimensional shape has a unique point mathematically defined as the "Center of Area." (*Id.*, 2:23-26.) The disclosed computer of the system applies a center of area algorithm to analyze images of targets on objects. (*Id.*, 2:35-3:40; *id.*, 6:30-36 ("For example, if three or more target points are scanned by the video camera then the system can give a photogrammetric solution to the position and orientation of an object in relation to the camera.").)

More specifically, a combination of switches and counters are controlled from the computer to set a window size (Δx, Δy) when analyzing image data. (*Id.*, 4:60-68, FIG. 5.)

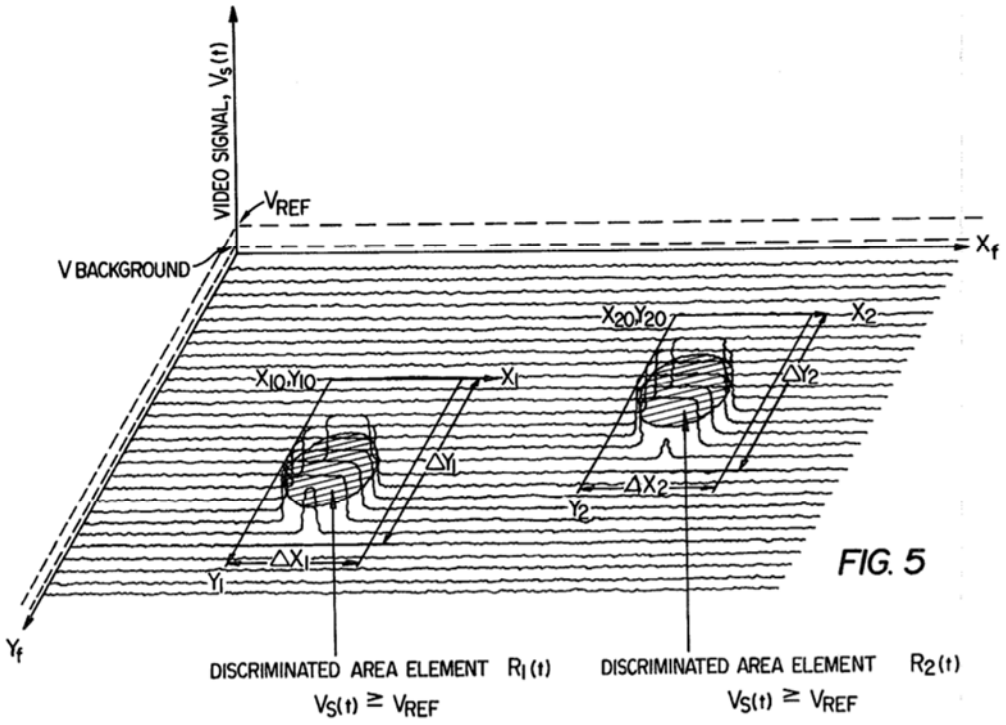


FIG. 5

(*Id.*, FIG. 5 (illustrating various targets processed with a camera outputting a video signal).) The computer provides x-position and y-position data to window position logic and compares captured image voltage information to a threshold. (*Id.*, 5:3-51.) Through this process, the computer can generate area and moment information, *id.*, as well as use x and y coordinate data to calculate a centroid location of a target on an object. (*Id.*, Abstract ("A method of obtaining on-line data useful in determining the center of area or centroid of a geometrical area of unspecified shape lying in a larger x-y scan field and having its existence indicated by a level discriminated amplitude or intensity or a parameter measurable in the z-dimension."); *id.*, 2:19-36 (describing various "mathematical foundations" of a method to determine the precise location of the center of area of a target).)

In all, the methods described by *Pinkney* are "useful in determining the center of area or centroid of a geometrical area of unspecified shape" lying in a camera field of view. (*Id.*, Abstract.) For example, *Pinkney*'s methods offered ready improvements for similar position and orientation related systems which "use[d] edges (rise-time) of pulse) or small bright targets (one-two picture points)," etc. during image analysis. (*Id.*, 2:25-34.)

Because *Pinkney* relates to photogrammetric techniques for use in optical sensing, *Pinkney* is in the same or similar technical field as *Liebermann* and the '431 patent, and a POSITA would

have had reason to consider the teachings of *Pinkney* when implementing the *Liebermann* system. (*Supra* Sections III.A, V.A.1; Ex. PA-DEC, ¶¶ 82-87.) To the extent *Pinkney* is not within the field of endeavor of the '431 patent, *Pinkney* is reasonably pertinent to problems associated with accurately determining position and orientation of objects in optical sensing or image analysis systems, problems with which the inventor was involved. (*Supra* Sections III.A, V.A.1; Ex. PA-DEC, ¶¶ 82-87.)

2. Claim 7

As explained below, *Liebermann* discloses or suggests the limitations recited in claim 7. (Ex. PA-DEC, ¶¶ 198-206.)

a. [7.a] Handheld computer apparatus comprising:

To the extent the preamble is limiting, *Liebermann* discloses or suggests this limitation for the reasons discussed *supra* for claim 7.a in SNQ1. (Section V.A.8.a; Ex. PA-DEC, ¶ 198.)

b. [7.b] a housing;

Liebermann discloses or suggests this limitation for the reasons discussed *supra* for claim 7.b in SNQ1. (Section V.A.8.b; Ex. PA-DEC, ¶ 199.)

c. [7.c] a camera means associated with said housing for obtaining an image using reflected light of at least one object positioned by a user operating said object;

Liebermann discloses or suggests this limitation for the reasons discussed *supra* for claim 7.c in SNQ1. (Section V.A.8.b; Ex. PA-DEC, ¶ 200.)

d. [7.d] computer means within said housing for analyzing said image to determine information concerning a position or movement of said object; and

Liebermann in view of *Pinkney* discloses or suggests this limitation. (Ex. PA-DEC, ¶¶ 201-205.) As described for limitation 7.d of SNQ1 (*see* Section V.A.8.d), *Liebermann* discloses or suggests this limitation under PO's interpretation that no construction is required for this term

(consistent with the district court construction order), as well as under PO's alternative interpretation under 35 U.S.C. § 112, ¶ 6. (Sections IV.G.2, V.A.8.d.) When construed under 35 U.S.C. § 112, ¶ 6 according to Requester's construction, *Liebermann* in view of *Pinkney* discloses or suggests "a computer programmed to (1) scan the pixel elements in a matrix array on which said image is formed, and then calculate the centroid location "x,y" of a target on the object using the moment method disclosed in U.S. Patent No. 4,219,847 to Pinkney, as disclosed at 4:48-62 [of the '431 patent]; (2) add or subtract said image from prior images and identify movement blur, as disclosed at 6:64-7:14, 7:22-29 [of the '431 patent]; (3) obtain a time variant intensity change in said image from the detected output voltage from the signal conditioning of the camera means or by subtracting images and observing the difference due to such variation, as disclosed at 8:25-38 [of the '431 patent]; or (4) detect a change in color reflected from a diffractive, refractive, or interference based element on said object that reflects different colors during movement, as disclosed at 8:60-9:14 [of the '431 patent]." (Section IV.G.2; Ex. PA-1, 4:48-62, 6:64-7:14, 7:22-29, 8:25-38, 8:60-9:14; Ex. PA-DEC, ¶ 201.) In particular, a POSITA would have found it obvious to modify *Liebermann* in view of *Pinkney* so that the cellular phone's computer is programmed to "(1) scan the pixel elements in a matrix array on which said image is formed, and then calculate the centroid location "x,y" of a target on the object using the moment method disclosed in U.S. Patent No. 4,219,847 to Pinkney, as disclosed at 4:48-62 [of the '431 patent]." (Ex. PA-DEC, ¶ 201.)

Pinkney describes a system "for evaluation in real time of a video signal to determine image plane coordinates of targeted contrast elements." (Ex. PA-6, 1:7-12) The system includes a computer that operates a camera 17 to view the relative position of target points, where the camera 17 transmits a video signal to the computer with a photogrammetric resolution. (*Id.*, 1:65-2:18, 2:7-18.) Image data is processed using circuitry "for determining the x-y coordinates" and circuitry "for carrying out the photogrammetric calculations to provide position, orientation and velocity information." (*Id.*, 1:57-67.) To determine position and orientation information of an imaged object, *Pinkney* explains that any two-dimensional shape has a unique point mathematically defined as the "Center of Area." (*Id.*, 2:23-26.) The disclosed computer of the system applies a center of area algorithm to analyze images of targets on objects. (*Id.*, 2:35-3:40; *id.*, 6:30-36 ("For example, if three or more target points are scanned by the video camera then the system can give a photogrammetric solution to the position and orientation of an object in relation

to the camera.").) More specifically, a combination of switches and counters are controlled from the computer to set a window size (Δx, Δy) when analyzing image data. (*Id.*, 4:60-68.) The computer provides x-position and y-position data to window position logic and compares captured image voltage information to a threshold. (*Id.*, 5:3-51.) Through this process, the computer can generate area and moment information, as well as use x and y coordinate data to calculate a centroid location of a target on an object. (*Id.*, 5:3-51, Abstract ("A method of obtaining on-line data useful in determining the center of area or centroid of a geometrical area of unspecified shape lying in a larger x-y scan field and having its existence indicated by a level discriminated amplitude or intensity or a parameter measurable in the z-dimension."); *id.*, 2:19-36 (describing various "mathematical foundations" of a method to determine the precise location of the center of area of a target); Ex. PA-DEC, ¶ 202.)

A POSITA would have had reason to consider *Pinkney* when contemplating implementation of *Liebermann's* cellular phone discussed above given, for example, both references relate to camera-based position and/or orientation features and are in the same field of endeavor. (*See e.g.*, Ex. PA-1, 1:10-3:67; Ex. PA-6, Abstract, 1:6-23, 2:6-18.) Thus, a POSITA would have looked to teachings like *Pinkney* when considering the above designs and implementations of the *Liebermann* gesture-based features. (Ex. PA-DEC, ¶ 203.)

Upon consideration of *Pinkney*, and in context of the state of the art, a POSITA would have found it obvious to modify the *Liebermann* cellular phone to program the internal computer so that it calculates a center of area as in *Pinkney*. (Ex. PA-DEC, ¶ 204.) As described for claim 16 in Section V.A.16, *Liebermann* discloses or suggests that the gesture recognition method requires determining the coordinate positions and movements of the user's hand by calculating the hand's center of gravity. (Section V.A.16.) A POSITA would have understood that when detecting signs with lateral movement (i.e., in the x-y plane), it would be desirable to improve *Liebermann*'s hand position and movement detection by implementing a precise algorithm, as described in the *Pinkney* moment method, for determining the center of area of the user's hand within that x-y plane. (Ex. PA-DEC, ¶ 204.) As described above, a POSITA would have recognized that implementing such a modification would have involved programming the *Liebermann* cellular phone's internal computer to scan the image provided by the video camera as an x-y array (i.e., scanning the pixel elements of the image in a matrix array formation), and then programming the computer to perform the *Pinkney* algorithm as described above. (*Id.*)

A POSITA would have had a reasonable expectation of success in implementing this modification given that the modifications would have involved implementing the algorithm taught by *Pinkney* in the *Liebermann* cellular phone according to well-known computer programming principles. (*Id.*, ¶ 205.) Moreover, a POSITA would have had the skill to implement, and expectation of success in achieving, such modifications because they would have involved a combination of known technologies (e.g., coordinate-based gesture detection systems (*Liebermann*)) according to known methods (e.g., methods of determining an x-y center of area (*Pinkney*)) to yield the predictable result of a process as discussed above to produce more accurate gesture detection for signs incorporating lateral movement in the x-y plane. (*Id.*) *See KSR Intern. Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007). Thus, when limitation 7.d is interpreted according to Requester's construction under 35 U.S.C. § 112, ¶ 6, *Liebermann* in view of *Pinkney* discloses or suggests "a computer programmed to (1) scan the pixel elements in a matrix array on which said image is formed, and then calculate the centroid location "x,y" of a target on the object using the moment method disclosed in U.S. Patent No. 4,219,847 to Pinkney, as disclosed at 4:48-62 [of the '431 patent]." (Section IV.G.2; Ex. PA-DEC, ¶ 205.)

Accordingly, *Liebermann* in view of *Pinkney* discloses or suggests this limitation under Requester's proposed construction for the claimed "computer means." (Section IV.G.2.)

e. [7.e] means for controlling a function of said apparatus using said information.

Liebermann discloses or suggests this limitation for the reasons discussed *supra* for claim 7.e in SNQ1. (Section V.A.8.b; Ex. PA-DEC, ¶ 206.)

3. Claim 8

a. Apparatus according to claim 7, wherein said object is a finger.

Liebermann in view of *Pinkney* discloses or suggests the limitations recited in claim 8. (Ex. PA-DEC, ¶ 207.) *Liebermann* in view of *Pinkney* discloses or suggests these limitations for similar reasons to those explained for claim 7 of SNQ6 and claim 8 of SNQ1. (Sections V.F.2, V.A.9.)

4. Claim 9

a. Apparatus according to claim 7, further including a display function which is controlled.

Liebermann in view of *Pinkney* discloses or suggests the limitations recited in claim 9. (Ex. PA-DEC, ¶ 208.) *Liebermann* in view of *Pinkney* discloses or suggests these limitations for similar reasons to those explained for claim 7 of SNQ6 and claim 9 of SNQ1. (Sections V.F.2, V.A.10.)

5. Claim 11

a. Apparatus according to claim 7, further including means for transmitting information.

Liebermann in view of *Pinkney* discloses or suggests the limitations recited in claim 11. (Ex. PA-DEC, ¶ 209.) *Liebermann* in view of *Pinkney* discloses or suggests these limitations for similar reasons to those explained for claim 7 of SNQ6 and claim 11 of SNQ1. (Sections V.F.2, V.A.11.)

6. Claim 12

a. Apparatus according to claim 7, further including a light source for illuminating said object.

Liebermann in view of *Pinkney* discloses or suggests the limitations recited in claim 12. (Ex. PA-DEC, ¶ 210.) *Liebermann* in view of *Pinkney* discloses or suggests these limitations for similar reasons to those explained for claim 7 of SNQ6 and claim 12 of SNQ1. (Sections V.F.2, V.A.12.)

7. Claim 13

a. Apparatus according to claim 7, wherein said apparatus is a cellular phone.

Liebermann in view of *Pinkney* discloses or suggests the limitations recited in claim 13. (Ex. PA-DEC, ¶ 211.) *Liebermann* in view of *Pinkney* discloses or suggests these limitations for similar reasons to those explained for claim 7 of SNQ6 and claim 13 of SNQ1. (Sections V.F.2, V.A.13.)

G. SNQ7: *Liebermann* in view of *Pinkney* and *Maruno*

As explained below and in the attached declaration of Dr. Abowd (Ex. PA-DEC), *Liebermann* in view of *Pinkney* and *Maruno* discloses or suggests the limitations of claims 9 and 10 of the '431 patent. (Ex. PA-DEC, ¶¶ 63-66, 71-75, 82-87, 212-214.)

1. Claim 9

a. Apparatus according to claim 7, further including a display function which is controlled.

Liebermann in view of *Pinkney* and *Maruno* discloses or suggests the limitations recited in claim 9. (Ex. PA-DEC, ¶ 213.) *Liebermann* in view of *Pinkney* and *Maruno* discloses or suggests these limitations for similar reasons as described for claim 7 of SNQ6 and claim 9 of SNQ3. (Sections V.F.2, V.C.2.) In particular, Section V.F.2 describes how *Liebermann* in view of *Pinkney* discloses or suggests claim 7 when interpreted according to Requester's construction under 35 U.S.C. § 112, ¶ 6, and Section V.C.2 describes how *Liebermann* in view of *Maruno* discloses or suggests claim 9 when interpreted according to Requester's construction under 35 U.S.C. § 112, ¶ 6. (Sections V.F.2, V.C.2; Ex. PA-DEC, ¶ 213.)

2. Claim 10

a. Apparatus according to claim 9, wherein said display is 3D display.

Liebermann in view of *Pinkney* and *Maruno* discloses or suggests the limitations recited in claim 10. (Ex. PA-DEC, ¶ 214.) *Liebermann* in view of *Pinkney* and *Maruno* discloses or suggests these limitations for similar reasons as described for claim 7 of SNQ6 and claim 10 of SNQ3. (Sections V.F.2, V.C.3.) In particular, Section V.F.2 describes how *Liebermann* in view of *Pinkney* discloses or suggests claim 7 when interpreted according to Requester's construction under 35 U.S.C. § 112, ¶ 6, and Section V.C.3 describes how *Liebermann* in view of *Maruno* discloses or suggests claim 10 when claim 9 is interpreted according to Requester's construction under 35 U.S.C. § 112, ¶ 6. (Sections V.F.2, V.C.3; Ex. PA-DEC, ¶ 214.)

H. SNQ8: *Liebermann* in view of *Pinkney* and *Mack*

As explained below and in the attached declaration of Dr. Abowd (Ex. PA-DEC), *Liebermann* in view of *Pinkney* and *Mack* discloses or suggests the limitations of claim 10 of the '431 patent. (Ex. PA-DEC, ¶¶ 63-66, 80-87, 215-216.)

1. Claim 10

a. Apparatus according to claim 9, wherein said display is 3D display.

Liebermann in view of *Pinkney* and *Mack* discloses or suggests the limitations recited in claim 10. (Ex. PA-DEC, ¶ 216.) *Liebermann* in view of *Pinkney* and *Mack* discloses or suggests these limitations for similar reasons as described for claim 7 of SNQ6 and claim 10 of SNQ5. (Sections V.F.2, V.E.2.) In particular, Section V.F.2 describes how *Liebermann* in view of *Pinkney* discloses or suggests claim 7 when interpreted according to Requester's construction under 35 U.S.C. § 112, ¶ 6, and Section V.E.2 describes how *Liebermann* in view of *Mack* discloses or suggests claim 10 when claim 9 is interpreted according to PO's interpretation that no construction is required. (Sections V.F.2, V.E.2; Ex. PA-DEC, ¶ 216.)

VI. Detailed Explanation of the Pertinence and Manner of Applying the Prior Art to the Claims

A. Bases for Proposed Rejections of the Claims

The following is a quotation of pre-AIA 35 U.S.C. § 102 that forms the basis for all of the identified prior art:

> A person shall be entitled to a patent unless...
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States … .

The following is a quotation of pre-AIA 35 U.S.C. § 103(a) that forms the basis of all of the following obviousness rejections:

> A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negative by the manner in which the invention was made.

The question under 35 U.S.C. § 103 is whether the claimed invention would have been obvious to one of ordinary skill in the art at the time of the invention. In *KSR International Co. v. Teleflex Inc*., 550 U.S. 398 (2007), the Court mandated that an obviousness analysis allow for "common sense" and "ordinary creativity," while at the same time not requiring "precise teachings directed to the specific subject matter of the challenged claim[s]." *KSR Int'l Co.*, 550 U.S. at 418, 420-421. According to the Court, "[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *Id.* at 416. In particular, the Court emphasized "the need for caution in granting a patent based on the combination of elements found in the prior art." *Id.* at 401. The Court also stated that "when a patent simply arranges old elements with each performing the same function it had been known to perform and yields no more than one would expect from such an arrangement, the combination is obvious." *Id.* at 417.

The Office has provided further guidance regarding the application of *KSR* to obviousness questions before the Office.

> If a person of ordinary skill can implement a predictable variation, § 103 likely bars its patentability. For the same reason, if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.

MPEP § 2141(1) (quoting *KSR* at 417.)

The MPEP identifies many exemplary rationales from *KSR* that may support a conclusion of obviousness. Some examples that may apply to this reexamination include:

- Combining prior art elements according to known methods to yield predictable results;
- Simple substitution of one known element for another to obtain predictable results;
- Use of a known technique to improve similar devices in the same way;
- Applying a known technique to improve devices in the same way;
- Choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success ("obvious to try")

MPEP § 2141(III).

In addition, the Office has published *Post-KSR* Examination Guideline Updates. *See* Fed. Reg. Vol. 75, 53464 (the "Guideline Updates".) The Guideline Updates discuss developments after *KSR* and provide teaching points from recent Federal Circuit decisions on obviousness. Some examples are listed below:

> A claimed invention is likely to be obvious if it is a combination of known prior art elements that would reasonably have been expected to maintain their respective properties or functions after they have been combined.

Id. at 53646.

> A combination of known elements would have been prima facie obvious if an ordinary skilled artisan would have recognized an apparent reason to combine those elements and would have known how to do so.

Id. at 53648.

> Common sense may be used to support a legal conclusion of obviousness so long as it is explained with sufficient reasoning.

Id.

B. Proposed Rejections

Pursuant to 37 C.F.R. § 1.510(b)(2), Requester identifies claims 1-31 as the claims for which reexamination is requested. The proposed rejections below, in conjunction with the analysis in Sections IV-V above and the attached declaration of Dr. Abowd (Ex. PA-DEC), provide a detailed explanation of the pertinence and manner of applying the prior art to each of claims 1-31.

1. Proposed Rejection #1

Claims 1-9, 11-21, 25-26, 28-31 are obvious over *Liebermann* under 35 U.S.C. § 103(a), as shown by the discussion of *Liebermann* above in Section V.A and the declaration of Dr. Abowd provided in Exhibit PA-DEC.

2. Proposed Rejection #2

Claim 20 is obvious over *Liebermann* in view of *Harakawa* under 35 U.S.C. § 103(a), as shown by the discussion of *Liebermann* and *Harakawa* above in Section V.B and the declaration of Dr.Abowd provided in Exhibit PA-DEC.

3. Proposed Rejection #3

Claims 9, 10, 22, and 23 are obvious over *Liebermann* in view of *Maruno* under 35 U.S.C. § 103(a), as shown by the discussion of *Liebermann* and *Maruno* above in Section V.C and the declaration of Dr. Abowd provided in Exhibit PA-DEC.

4. Proposed Rejection #4

Claim 24 is obvious over *Liebermann* in view of *Maruno* and *Maguire* under 35 U.S.C. § 103(a), as shown by the discussion of *Liebermann* and *Maguire* above in Section V.D and the declaration of Dr. Abowd provided in Exhibit PA-DEC.

5. Proposed Rejection #5

Claims 10, 23, and 27 are obvious over *Liebermann* in view of *Mack* under 35 U.S.C. § 103(a), as shown by the discussion of *Liebermann* and *Mack* above in Section V.E and the declaration of Dr. Abowd provided in Exhibit PA-DEC.

6. Proposed Rejection #6

Claims 7-9 and 11-13 are obvious over *Liebermann* in view of *Pinkney* under 35 U.S.C. § 103(a), as shown by the discussion of *Liebermann* and *Pinkney* above in Section V.F and the declaration of Dr. Abowd provided in Exhibit PA-DEC.

7. Proposed Rejection #7

Claims 9 and 10 are obvious over *Liebermann* in view of *Pinkney* and *Maruno* under 35 U.S.C. § 103(a), as shown by the discussion of *Liebermann*, *Pinkney*, and *Maruno* above in Section V.G and the declaration of Dr. Abowd provided in Exhibit PA-DEC.

8. Proposed Rejection #8

Claim 10 is obvious over *Liebermann* in view of *Pinkney* and *Mack* under 35 U.S.C. § 103(a), as shown by the discussion of *Liebermann*, *Pinkney*, and *Mack* above in Section V.H and the declaration of Dr. Abowd provided in Exhibit PA-DEC.

VII. Conclusion

For the reasons set forth above, the Requester has established at least one substantial new question of patentability with respect to claims 1-31 of the '431 patent. The analysis provided in this Request and in the declaration of Dr. Abowd (Ex. PA-DEC) demonstrates the invalidity of claims 1-31 in view of prior art that was not substantively considered by the Patent Office. Therefore, it is requested that this request for reexamination be granted and claims 1-31 be cancelled.

As identified in the attached Certificate of Service and in accordance with 37 C.F.R. §§ 1.33(c) and 1.510(b)(5), a copy of this Request has been served, in its entirety, to the address of the attorney of record.

Respectfully submitted,

PAUL HASTINGS LLP

Dated: November 11, 2021

By: /Joseph E. Palys/
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